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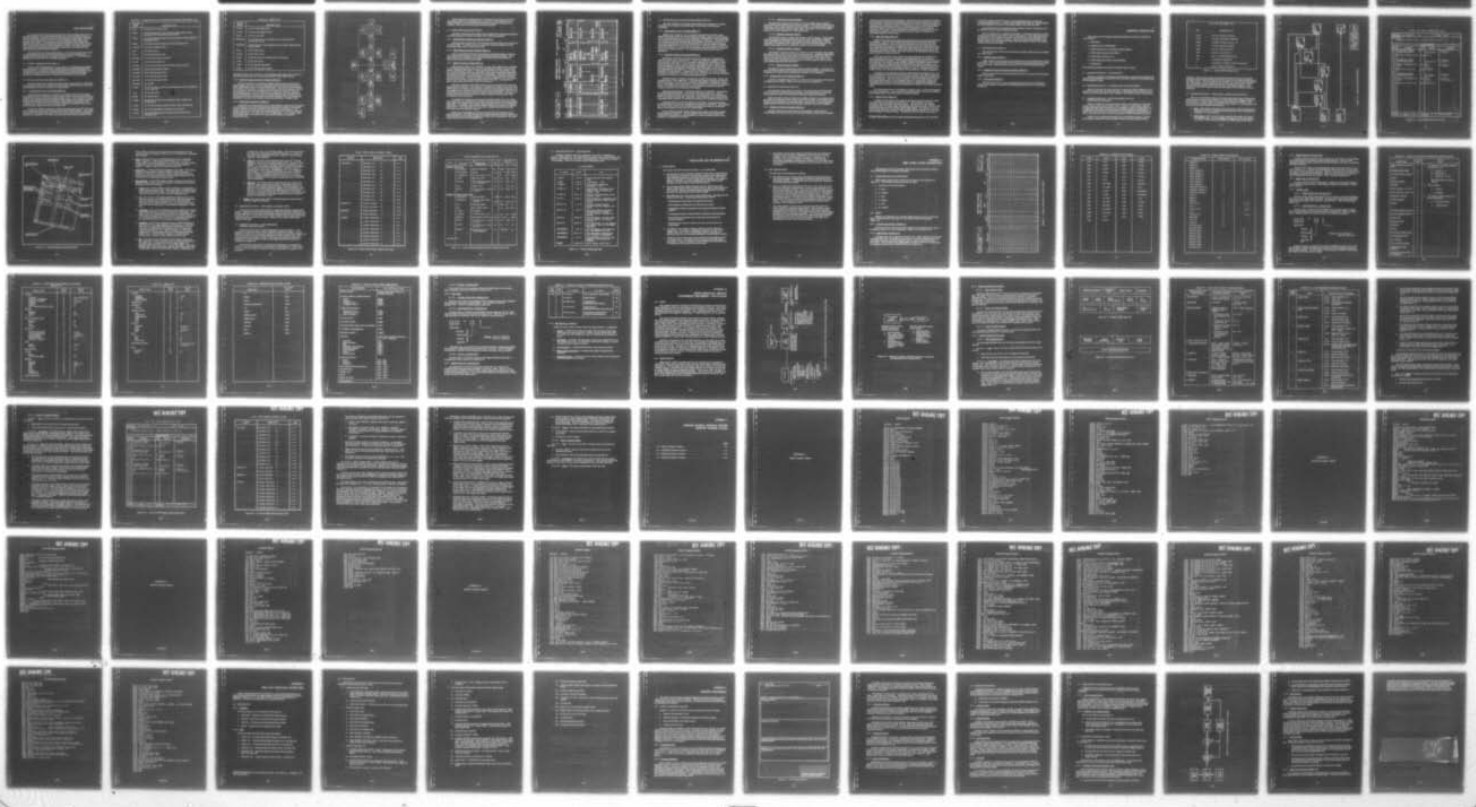

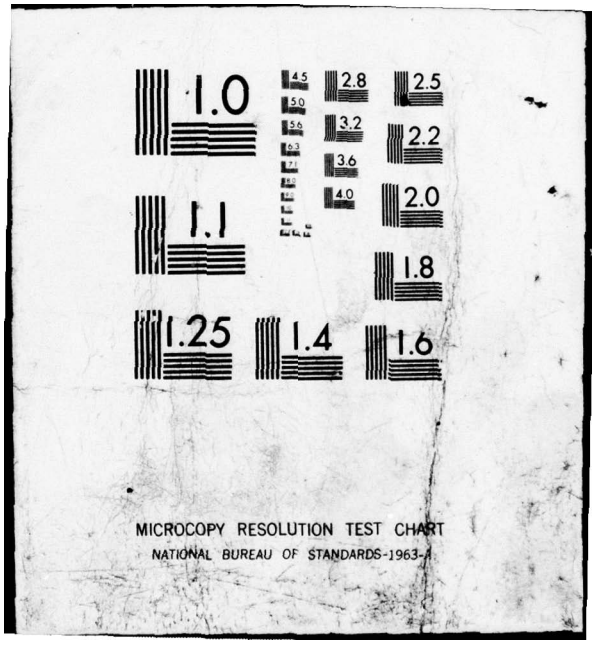
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Final Report

STANDARD AVIONICS INTERFACE PROGRAM

Volume I

Contract Performance Summary

August 1976

Prepared for

DIRECTORATE OF INTEGRATED LOGISTICS MANAGEMENT
OFFICE OF DCS/ACQUISITION LOGISTICS
HEADQUARTERS AIR FORCE LOGISTICS COMMAND
Wright-Patterson Air Force Base, Ohio 45433

Under Contract F09603-75-A-3001-Q701

ARINC RESEARCH CORPORATION

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Described in this two-volume report are the work performed and methods used in developing a 33-volume Navigation Equipment Integration Handbook for a like number of aircraft position, navigation, and weapon delivery systems (Volume I), and an abstract of the recorded data (Volume II).

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ABSTRACT

Described in this two-volume report are the work performed and methods used in developing a 33-volume Navigation Equipment Integration Handbook for a like number of aircraft position, navigation, and weapon delivery systems (Volume I), and an abstract of the recorded data (Volume II).

SUMMARY

This document, Volume I of a two-part final report under Contract F09603-75-A-3001-Q701, describes the work performed and methods used in developing a Navigation Equipment Integration Handbook (NEIH) for the Air Force Logistics Command. The handbook comprises 33 volumes of interface/integration data on position, navigation, and weapon delivery (PNWD) systems of as many different models of Air Force aircraft. The handbook is intended to be used by system designers and integrators to promote the standardization of avionics interfaces for new or retrofit installations.

The handbook development effort consisted of identifying, analyzing, and tracing signal paths of the PNWD system for each aircraft type of interest, and compiling the results of those tasks into a concise handbook format. Each volume contains PNWD equipment lists, system block diagrams, signal characteristic sheets, signal category indexes, physical characteristic lists, bibliographies, and handbook use and maintenance instructions. An abstract of those portions of the data and text common to all 33 aircraft types constitutes Volume II of the final report.

Most of the material in the handbook, particularly the signal routing and functional characteristics data, was recorded on coding forms for input into a computer program for automatic sorting, formatting, and printout on a remote computer terminal. Other sections, for which automatic data or word processing was not considered feasible or cost effective, were prepared manually.

Development and production of the handbook was a team activity comprising numerous interrelated tasks. Thus, a well organized and coordinated management plan was developed, based on a carefully designed work breakdown structure. The primary tasks included:

a. Project administration

b. Data collection and handling

c. PNWD system analysis

d. Procedures and methods development

e. Handbook production

f. Documentation.

The majority of the effort was concentrated in b, c, and e, which included collecting the necessary data, analyzing and coding it, and processing and formatting the results into a handbook volume for each aircraft.

Production of the handbook is not considered an end in itself – for maximum usefulness all volumes must be kept in an accurate, up-to-date status. Procedures and methods were developed for achieving this objective. The procedures describe the types of handbook changes anticipated and how they should be implemented through a combined effort of the handbook users and an AFLC handbook maintenance activity.

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1
INTRODUCTION

1.1 BACKGROUND

The Air Force Logistics Command is conducting a Standard Avionics Interface Program to provide aircraft system designers and integrators with convenient sources of information on interface requirements for new avionics. At present, the information required for integration/interface analysis is widely dispersed in technical orders (TOs), engineering drawings, and manufacturers' specifications. Compiling this information for the use in design of new avionics systems is a difficult task, which is not always performed adequately to ensure smooth, successful, and economical integration. By providing integration information in a form convenient to designers of new avionics, integration requirements can be addressed during the design process. Thus, the cost of integration and the number of interface problems can be reduced. The Standard Avionics Interface Program will also promote common interfaces and thereby increase standardization across weapon systems.

Results of the Standard Avionics Interface Program will be manifested in a handbook for use by engineers, designers, maintenance personnel, and others concerned with integrating or interfacing avionics with USAF aircraft. The handbook will promote the objectives of:

a. Reducing engineering and maintenance time in researching integration/interface data for particular aircraft series

b. Promoting the standardization of avionics equipment for retrofit applications

c. Contributing to cost-effective avionics integration and retrofit through identification of existing equipment interconnections and group A items that might be applied to new integration tasks or retrofits

d. Assisting in routine maintenance tasks and troubleshooting of avionics at the organizational level

e. Influencing the form, fit and electrical interfaces of new avionics intended for use as "swapouts" in future avionics retrofits.

This output of the Standard Avionics Interface Program, Navigation Equipment Integration Handbook (NEIH), provides detailed integration information on those avionics related to aircraft position, navigation, and weapon delivery system for 33 types of USAF aircraft.

1.2 SCOPE OF STUDY

Under Contract F0960[illegible]-75-A-3001-Q701 with AFLC, ARINC Research Corporation was directed to perform the following initial work under the Standard Avionics Interface Program:

a. Define the position, navigation, weapons delivery (PNWD) system interfaces for 33 types of Air Force aircraft; and

b. Prepare a Navigation Equipment Integration Handbook (NEIH) containing the PNWD interface data.

The NEIH has been prepared in 33 volumes covering each of the aircraft types of interest, and delivered separately under the contract. This report describes the contents of the handbook and the work performed by ARINC Research in producing it.

The Standard Avionics Interface Program is being directed by AFLC's Directorate of Integrated Logistics Management (AFLC/AQMP). The present effort was coordinated with the Deputy Program Manager for Logistics, NAVSTAR Global Positioning System (GPS), who was the Contracting Officer's Technical Representative (COTR).

Topics covered herein are the background of the study; the scope of the work performed; the procedure by which the handbooks were produced; the contents of the handbooks; and how the data therein can be used and applied. Specifically,

- Section 2 presents an overview of the tasks required by the contract and the general approach to implementing them

- Section 3 describes how the NEIH is organized

- Section 4 presents conclusions and recommendations from the handbook preparation effort

- Appendix A contains PNWD signal coding instructions; Appendix B presents the report-generation computer program specification; Appendix C lists the computer programs (EQUIP, GROUPER, SORTER, and REPORT); Appendix D provides data processing instructions; and Appendix E describes the handbook maintenance plan.

2
TASK DESCRIPTION

The contracted effort required two primary areas of performance that had to be carefully organized to coordinate effectively the vast amount of integration data produced for the NEIH. These task areas were the analysis of PNWD system interfaces for each of the aircraft listed in Table 2-1, and compilation of the results of the analysis into an NEIH. The analysis task included identifying PNWD intersystem interfaces from TO data, developing functional block diagrams of the PNWD avionics suite, and producing interface signal characteristic sheets. The NEIH compilation task consisted of formatting and processing the analyzed data into handbook form, using both automated and manual techniques.

As basic guidance for the contracted effort, a project plan was developed around a work breakdown structure (WBS) that organized the work into identifiable and manageable tasks and subtasks. The WBS is shown in Figure 2-1. The tasks identified thereon are discussed in the following paragraphs.

2.1 PROJECT ADMINISTRATION (WBS 1.0)

General project administration was performed on a continuing basis throughout the contract period. Responsibilities covered by this task included identifying and solving problems, preparing and maintaining budget and schedule allocations, providing customer liaison, preparing monthly progress reports and special briefing material, and identifying the correct model and serial block for each aircraft.

2.2 DATA COLLECTION AND HANDLING (WBS 2.0)

The data collection and handling task included three basic subtasks: compilation of aircraft and avionics TOs, collection of PNWD system physical-characteristic data, and preparation of a source-document list (bibliography).

2.2.1 Aircraft and Avionics TO Handling (WBS 2.1)

After the aircraft models to be covered in the handbook had been established, the necessary TOs for analyzing the PNWD systems in those aircraft were ordered and received from the appropriate Air Logistics Center (ALC). TOs for specific avionics systems were ordered periodically during the initial stages of the contract as required to supplement the data in the aircraft TOs and obtain physical characteristic data. However, it was found to be more convenient to obtain this information from the TOs in the Inspector General (IG) Library at Norton AFB.

TOs and TO changes received as a result of the initial data request for the latest and/or largest block of aircraft formed the basis for the PNWD analysis. Any TO data received after the analysis was started for an aircraft, and which were not absolutely required for compilation of the study, were not used if they seriously impacted work

TABLE 2-1. AIRCRAFT MODELS AND SERIES COVERED IN NEIH (Sheet 1 of 2)

Aircraft Model	Applicable Series
A-7D	AF 69-6189; 69-6197 and up
B-52D	AF 55-049 through 55-117; 55-673 through 55-680; 56-580 through 56-630; and 56-658 through 56-698
B-52G	AF 57-6468 through 57-6520; 58-158 through 58-258; and 59-2564 through 59-2602
B-52H	AF 60-001 through 60-062; and 61-001 through 61-040
FB-111A	AF 68-281 through 69-6514
C-5A	AF 69-019 and up
C-9A	AF 71-874 through 71-882
HC-130H	AF 64-14852 through AF 65-989
C-135A	AF 60-376 through 60-378
EC-135C	AF 62-3581 through 3585; and 63-8046 through 63-8054
KC-135A	AF 55-3118 through 64-14840
RC-135A	AF 63-8058 through 63-861
VC-135B	AF 62-4125 through 62-4127
WC-135B	AF 61-2665 through 61-2674
VC-140B	AF 61-2490
C-141A	AF 66-131 and up; and AF 61-2776 through 66-130 if modified by TO 1C-141A-696
F-4E	AF 72-1499 and up
RF-4C	AF 69-945 and up
F-106A	AF 56-453; 56-454; 56-456 through 57-245; 57-2465; and 58-759 and up
F-106B	AF 57-2508 through 57-2515; 57-2523; and 57-2532 and up
F-111A	AF 67-058 through 67-114 after TO 1F-111-1013
F-111D	AF 68-086 through 68-165; 68-167; 68-170; and 68-173 through 68-180

TABLE 2-1. (Sheet 2 of 2)

Aircraft Model	Applicable Series
F-111E	AF 67-115 through 68-084
F-111F	AF 72-1441 through 73-00718
TH-1F	All TH-1F aircraft
HH/CH-3E	AF 66-13278 and up; and CH-3E aircraft serial numbers AF 66-13284 and up
HH-53B/C	All HH-53B/C aircraft equipped with the Limited Night Recovery System (LNRS)
O-2A	AF 67-21295 and up
OV-10A	AF 66-13552 and up
T-37B	AF 59-241 and up, as modified by TO 1T-37B-521
T-38A	AF 68-8161 and up
T-39A	AF 62-4448 and subsequent
T-43A	AF 71-1403 through 73-01156

previously performed or in progress. Wiring diagram TOs superseded all other TO interface drawings, and were the primary source for PNWD signal tracing.

2.2.2 Physical Characteristic Data Collection (WBS 2.2)

This task consisted of collecting the physical characteristic (dimension and weight) data for each piece of PNWD equipment considered logically replaceable by future modifications to the aircraft avionics systems. Most of the data was obtained from avionics TOs; however, in certain cases when the data did not appear in TOs, it was necessary to contact the manufacturer of the equipment directly to obtain the required information. For a few minor pieces of equipment, the time required to pursue obtaining this information became disproportionate to that remaining for the remainder of the tasks, and therefore some of the equipment entries in the physical characteristic section of the handbook do not have dimensions or weights listed.

2.2.3 Bibliography Preparation (WBS 2.3)

Preparation of the bibliography section of the handbook required the documenting of all publications from which information was obtained for the NEIH. These publications consisted of aircraft and avionics TOs and military specifications. The primary reference sources were the aircraft maintenance TOs as listed on the signal characteristic sheets. The other TOs, such as flight manuals, were used for background information. The avionics TOs were utilized primarily for physical characteristic data.

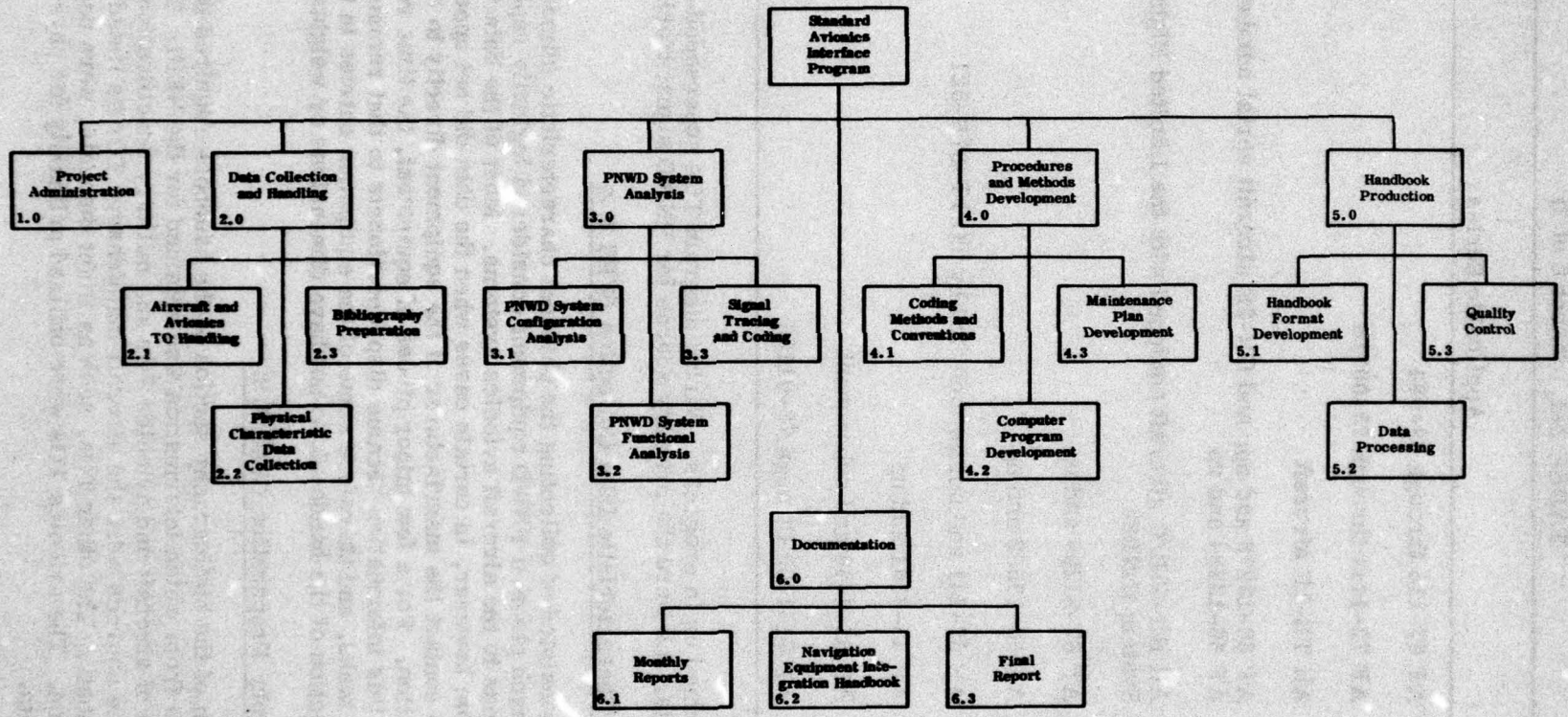


Figure 2-1. Work Breakdown Structure, Standard Avionics Interface Program

Not all of the PNWD equipment lists or physical characteristic sections have associated references in the bibliography, since data for some equipment were obtained directly from manufacturers through either telephone conversations or catalogs. Those sources are not listed in the bibliography.

2.3 PNWD SYSTEM ANALYSIS (WBS 3.0)

The PNWD analysis included PNWD system configuration and functional analysis, and signal tracing and coding as described in the following paragraphs.

2.3.1 PNWD System Configuration Analysis (WBS 3.1)

The appropriate aircraft TOs were reviewed to determine the correct block(s) of aircraft to study. The PNWD system for each block was then identified, and the equipments making up that system were listed.

2.3.2 PNWD System Functional Analysis (WBS 3.2)

Each aircraft PNWD subsystem was studied to determine the basic electrical and functional characteristics of its pertinent navigation interface signals. Inter-system functional relationships were analyzed and preliminary block diagrams prepared showing these interrelationships.

2.3.3 Signal Tracing and Coding (WBS 3.3)

After pertinent signals were identified, system wiring diagrams were consulted to trace interface signals from point to point throughout the system. This task consisted of identifying the origin of a signal and then tracing it to a destination. Each wire lead for the signal was traced separately, during which appropriate alpha codes and plug/pin information were entered on the coding sheets. If the signal divided at a junction point, each wire was followed until all wires for that particular signal had been traced and coded. Usually the signal tracing task progressed from one avionics system to the next until all systems had been traced and coded. An example of a typical coding sheet with entries is shown in Figure 2-2.

Final block diagrams of the PNWD system were prepared after the tracing and coding had been completed. The diagrams, in addition to serving as visual aids of the PNWD system, provided a quality assurance check for the tracing and coding process. The diagrams were limited to showing only single lines between blocks; otherwise, the multiplicity of lines would have made the charts virtually unreadable. Each line on a diagram therefore represents the group of signals flowing (in the direction of the arrowheads) between interfaces.

To expedite the coding process and allow the required data to fit on the coding form, alpha codes were assigned to the PNWD equipment shown on the block diagrams. Alpha codes were assigned in an acronym fashion for convenience in proofreading the coded data. For example, the horizontal situation indicator (or display) for the pilot became HSDP. The alpha codes were recorded on coding forms in a decode table format for use by the computer program.

The aircraft wiring diagram TOs were the most generally consulted for the signal tracing task. For some aircraft, the navigation system wiring information was contained in the communication/navigation TO; under these circumstances, the latter TO was used in lieu of a wiring diagram TO.

0 = Zero, 1 = One, 2 = Two
Ø = Alpha O, I = Alpha I, S = Alpha Z
–Alpha = Lower Case

ARINC Research Corporation
PNWD INTERFACE DATA

SYS: AN/ARN-58
ILS

SHEET NO. 3 OF 6
DATE 24 JULY 1975
WORK ORDER NO. 1296

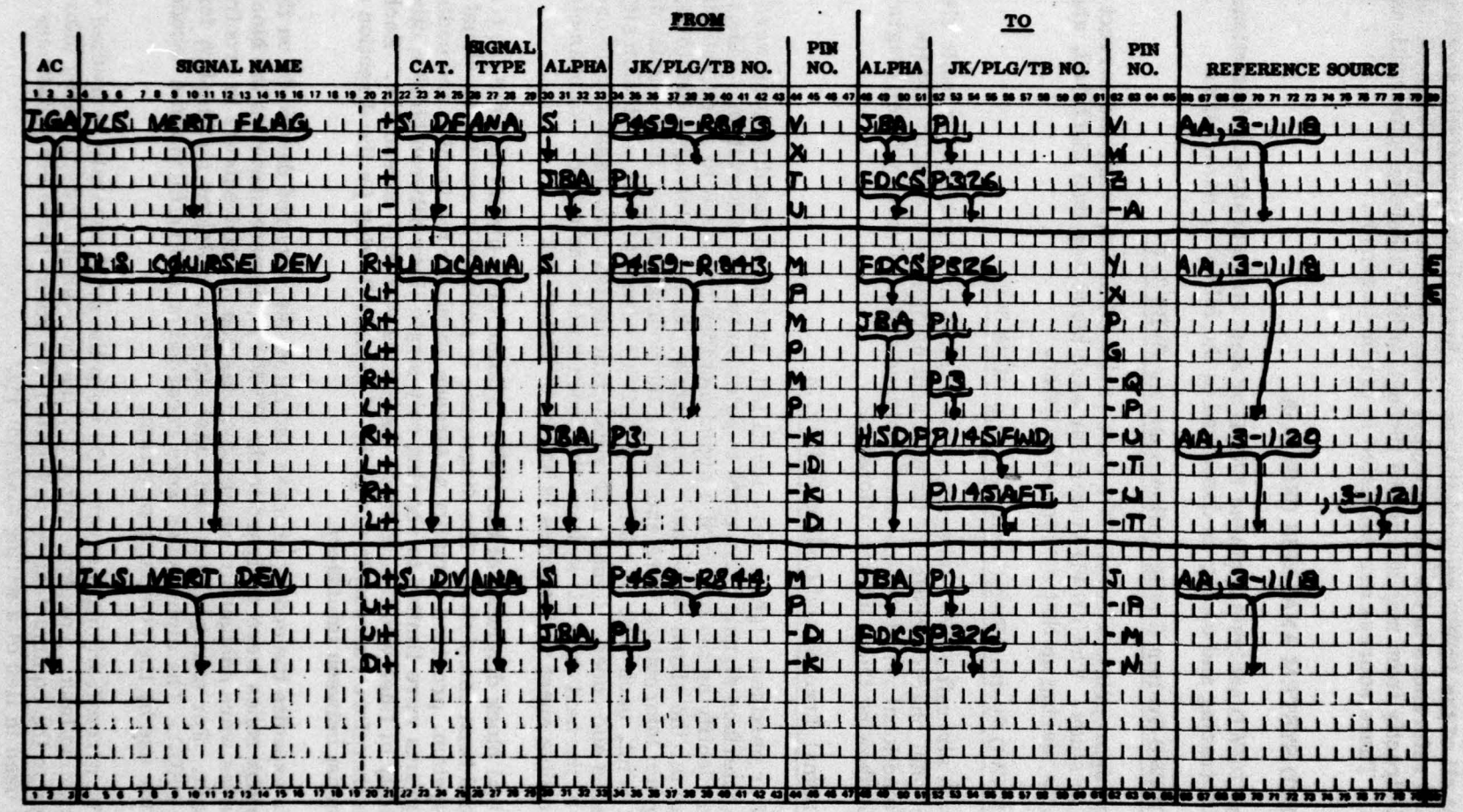


Figure 2-2. Typical Coding Form Entries

2.4 PROCEDURES AND METHODS DEVELOPMENT (WBS 4.0)

This task consisted of developing coding methods and conventions, computer programs, and a handbook maintenance plan, as discussed in the following paragraphs.

2.4.1 Coding Methods and Conventions (WBS 4.1)

Methods and conventions were developed to standardize the PNWD system analysis and coding routine for automatic data processing. Because of the 80-column limit on standard keypunch cards, care was taken in establishing a coding method that would permit maximum entry of encoded information on each card. The card columns were divided into specific headings that would identify all of the data required on a signal characteristic sheet, and the information to be coded was further condensed through the assignment of alpha codes (e.g., the No. 1 TACAN system was coded TA). Alpha codes unique to each aircraft were then entered into decode tables for interpretation by the computer program. The conventions and codes used are listed in Appendix A.

2.4.2 Computer Program Development (WBS 4.2)

Some areas of the NEIH analysis and production tasks were recognized as repetitive and/or prone to human error. These circumstances, together with the large amount of data that had to be documented, suggested the desirability of using automated data processing. Certain sections of the handbook were considered as prime candidates for computerized production; while other sections, such as those containing physical characteristic information and bibliographies, could also have been automated but less effectively. The block diagram section was not considered amenable to computerization. Computerized were Sections 1, 2, 4, and 5, and the equipment list of Section 3. Sections 1 and 2 were primarily text, and were automated by means of a simple word processing/text editing process.

Primary areas for computer mechanization included the grouping, sorting, and formatting of the PNWD signal data. To develop the computer programs for performing these routines, a specification was generated detailing the requirements of each area of the handbook to be programmed. That specification is presented as Appendix B herein. The specification became the common baseline document from which all computer programs were developed and/or changed.

Three separate programs – GROUPER, SORTER, and REPORT – evolved from the specification requirements. Each program has built-in data error checks to support the handbook quality control process. By dividing the overall computer procedure into three such programs, data errors could be detected and corrected before expending valuable computer processing time needlessly on subsequent program runs.

A fourth program was also developed, at a later date, to access the existing decode table data to produce the equipment list of Section 3 of the NEIH. This program was rather simple in that it did not require any special input data; the needed data appear in the equipment decode table for each aircraft.

The following paragraphs briefly describe each program, individual program listings appear in Appendix C. All four programs were run on the Control Data Corporation Cybernet System utilizing SCOPE 3.3 batch operating procedures and KRONOS 2.1 timesharing procedures.

2.4.2.1 GROUPER Computer Program

The GROUPER program was written in Fortran language using a modified standard 6000 series RUN-December Fortran compiler. The program groups PNWD signal data, input in the format described in Appendix B, into logical signal category groups based on the signal category alpha codes. The output is stored in computer memory in a format acceptable for input into SORTER.

2.4.2.2 SORTER Computer Program

The SORTER computer program was written in BASIC language. This program sorts and strings the data from GROUPER into the proper sequence and produces error statements when the signal route continuity cannot be determined. Special identifiers are inserted into the output data for use in the REPORT program. The output is automatically stored in computer memory for input into REPORT.

2.4.2.3 REPORT Computer Program

The REPORT computer program was written in Fortran language using a modified standard 6000 series RUN-December Fortran compiler. Using the decode tables, REPORT decodes the alpha codes output from SORTER, formats the data, and produces error statements when decode errors are encountered. The output is automatically stored in permanent computer memory storage (magnetic tape) for output on the PNWD signal characteristic sheets.

2.4.2.4 EQUIP Computer Program

The EQUIP computer program was written in BASIC language. This program selects the aircraft type peculiar equipment from the decode tables, formats the data, and stores it for output as the equipment list in Section 3 of the handbook.

2.4.3 Maintenance Plan Development (WBS 4.3)

A plan for maintaining the NEIH in an accurate and current status was developed during the contract effort. Details of the plan are given in Appendix E.

2.5 HANDBOOK PRODUCTION (WBS 5.0)

The integration data collected, analyzed, and coded during the PNWD system analysis task were processed by either manual or automated means to produce the various aircraft volumes of the Navigation Equipment Integration Handbook.

Before the data could be processed in any fashion, manual or automated, it was necessary to develop the format in which it was to be produced, and to ensure that its quality would be sufficient to provide confidence in its accuracy. The following paragraphs describe the format task and other tasks required to produce the handbook.

2.5.1 Handbook Format Development (WBS 5.1)

Because of the large amount of data to be documented, ARINC Research recommended, and the COTR concurred, that the handbook be divided into a separate

volume for each of the 33 aircraft analyzed. This division would increase the utility of the handbook and facilitate its distribution among the aircraft-cognizant Air Logistics Centers (ALCs). Each volume was divided into seven sections, covering the topics and data categories described in Section 3. The format for each section was then established on the basis of whether that section was to be manually or automatically processed. The formats of the sections to be automatically processed were coordinated with the computer programming effort in order to ensure a standardized processing routine for each volume.

2.5.2 Data Processing (WBS 5.2)

This task consisted of processing the coded data into the formats established for the handbook. After the PNWD signal characteristic data and decode tables were coded and keypunched for each aircraft, the information was loaded into the CDC SCOPE batch operating system for high-speed printout of the raw PWND signal data. This initial data processing step identified any data coding errors before the raw data entered the formatting programs. Any errors found on the high speed printout were corrected either on-line, if there were a few errors; or by punching new source data cards if there were numerous errors.

After being corrected, the raw data were then loaded into the KRONOS time-share computer system for manipulation and formatting by the four previously described computer programs. The automatic data processing routine was controlled by an operator at a remote computer terminal* located in the ARINC Research office. The output data, after being formatted by the EQUIP and REPORT programs, was printed on standardized handbook forms on the remote terminal under the control and monitoring of the operator as handbook Sections 3, 4, and 5. The instructions necessary to load, run, and print this data for each aircraft are provided in Appendix D.

In addition to automating the production of the handbook data sections (3, 4, and 5), it was decided to also automate the text sections (1 and 2) since their contents are nearly identical from volume to volume, the basic difference being the aircraft model and serial numbers. This coded data for Sections 1 and 2 were entered into a computer controlled timeshare word processing system for manipulation, editing, and formatting; and the output was automatically printed on a high quality typewriter/remote terminal under the control and monitoring of an operator at the ARINC Research office.

The remaining portions of the handbook, Sections 6 and 7 and the block diagrams, were prepared manually. These portions are aircraft-peculiar, and would not benefit from the application of automated data processing techniques.

2.5.3 Quality Control (WBS 5.3)

A quality control program was applied to the NEIH production process to eliminate data coding and handbook production errors. Both automated and manual procedures were incorporated into the program. The QC program was initiated immediately after the PNWD signal characteristic data had been coded, with the coded data going through several QC checks before being printed. The initial QC step was manual cross-checking of samples of the coded data with the original TO source data, and correcting of erroneous entries. The printout of the raw data was then used to

*Western Union Exchange Data Terminal 300 Keyboard Send Receive (EDT 300 KSR).

correct any computer-identified errors, and the KRONOS system to locate and correct any sequence errors. Finally, the formatted output data were checked against the block diagrams to determine if any signal tracing errors had been made.

QC procedures were also applied to other handbook sections, but they were not as rigorous as for the signal characteristic data.

After all sections were completed and checked, a preliminary draft copy of each volume was forwarded to the COTR for review and approval. This draft copy was also the vehicle for a final quality control check, particularly the cross-checking of comparative data from one section to another. Any errors found during this final review and QC process were corrected, after which the final handbook volumes were printed, collated, bound, and distributed.

2.6 DOCUMENTATION (WBS 6.0)

The documentation required for this contract included monthly reports, the NEIH, and a final report.

2.6.1 Monthly Reports (WBS 6.1)

Letter reports on the progress of the contracted work were submitted each month to the COTR. The reports summarized the work performed during the previous month, any problem areas, schedule status, and the work to be performed during the next month.

2.6.2 Navigation Equipment Integration Handbook (WBS 6.2)

The 33-volume NEIH was documented and delivered as described in the foregoing pages of this report.

2.6.3 Final Report (WBS 6.3)

The final report, in two volumes, summarizes the contract work performed (Volume I) and presents an abstract of NEIH data applicable to all 33 aircraft types (Volume II).

3
HANDBOOK ORGANIZATION

Each volume of the Navigation Equipment Integration Handbook is divided into seven sections:

1 – Introduction

2 – Handbook Use and Maintenance

3 – PNWD Equipment List and System Block Diagrams

4 – PNWD Signal Characteristic Sheets

5 – PNWD Signal Category Index

6 – PNWD Equipment Physical Characteristics

7 – Bibliography

The following paragraphs describe the contents of these sections.

3.1 HANDBOOK SECTION 1 – INTRODUCTION

Section 1 provides an introduction to the handbook, discussing its background and purpose and describing the conventions followed in PNWD analysis, block diagramming, and documentation usage.

3.2 HANDBOOK SECTION 2 – HANDBOOK USE AND MAINTENANCE

Section 2 discusses the steps necessary for using the handbook effectively, and describes a typical signal characteristic sheet. Maintenance responsibilities and procedures are also noted in this section, together with a handbook error-reporting form.

3.3 HANDBOOK SECTION 3 – PNWD EQUIPMENT LIST AND SYSTEM BLOCK DIAGRAMS

Section 3 includes the equipment list and system block diagrams for the PNWD system of the aircraft covered in that volume. Figure 3-1 herein shows a typical computer-generated PNWD equipment list. Equipment is listed in alphabetical order by alpha key codes, which were used during the PNWD analysis/coding process to standardize and simplify the identification of various equipment by the computer program. The codes are keyed to the block diagrams and signal characteristic sheets.

Figure 3-2 is a typical block diagram of an aircraft PNWD system. The diagram shows in single-line fashion the signal routing of only the major functional

T-38A PNWD EQUIPMENT LIST

KEY	EQUIPMENT/UNIT
AIMS	IFF-SIF SYSTEM AN/APX64
ALCM	CPU-46/A ALTITUDE COMPUTER
CMMM	INTERCOM SYSTEM AN/AIC -18
FDCS	FLIGHT DIRECTOR SYSTEM
HSDC	AQU-2/A COPILOT'S HSI
HSDP	AQU-2/A PILOT'S HSI
JBA	RADIO INTERCONNECTING BOX
RDA	DISCONNECT CONNECTOR
S	INSTRUMENT LANDING SYSTEM AN/ARN-58
T	TACAN SYSTEM AN/ARN-65

Figure 3-1. Typical PNWD Equipment List

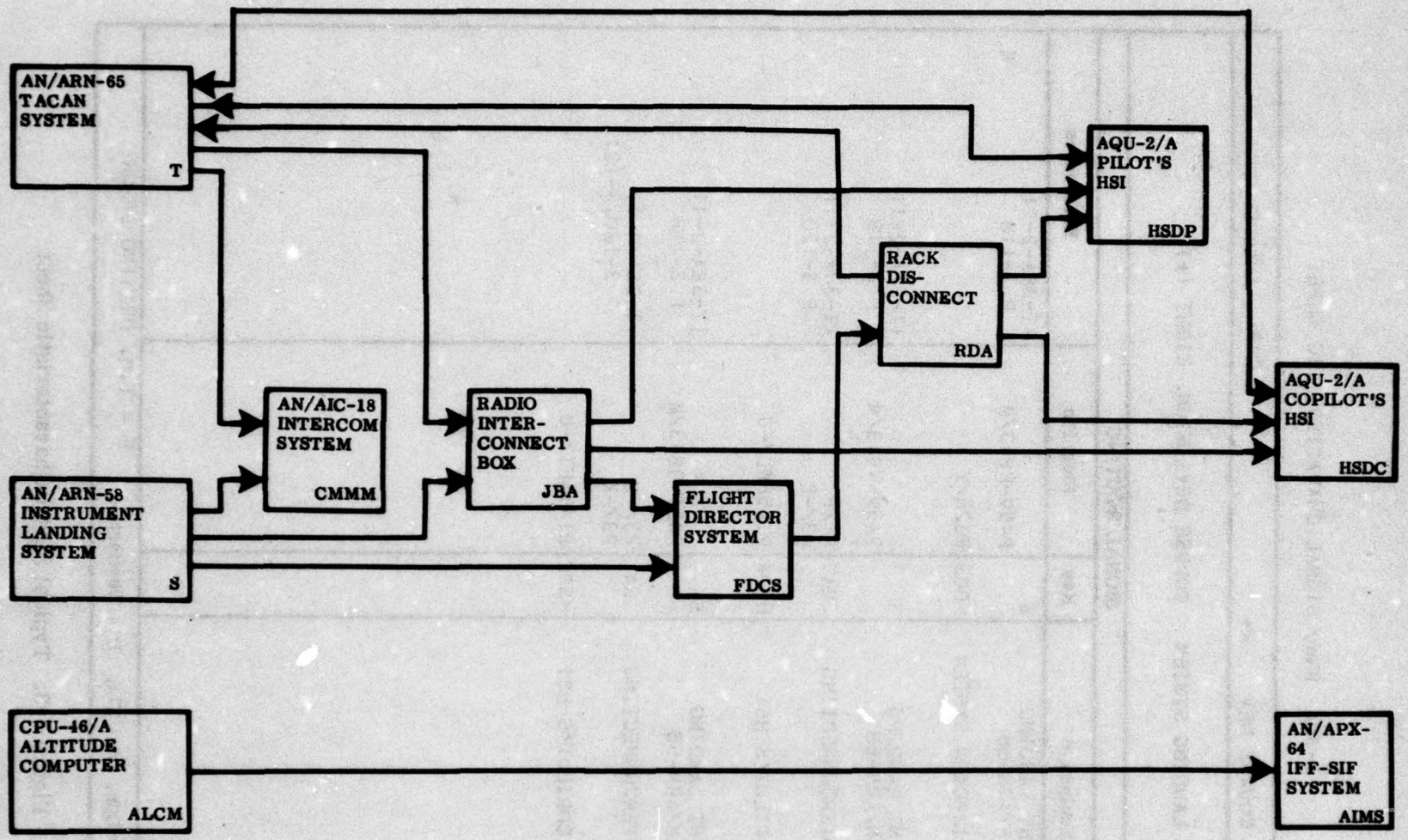
interfaces. Each interconnecting line between the blocks represents all pertinent functional interface signals flowing between the various major equipments that make up the PNWD system. The block diagrams are intended as a visual aid for the handbook user when tracing a signal through the system on the signal characteristic sheets. The arrowheads on the line indicate the direction of information transfer. More complex aircraft PNWD systems contain several pages of block diagrams and equipment lists.

3.4 HANDBOOK SECTION 4 – PNWD SIGNAL CHARACTERISTIC SHEETS

Section 4 of the handbook contains the computer-generated signal characteristic sheets produced for the aircraft analyzed. Each pertinent PNWD signal is listed on a separate sheet, including multiple line signals such as synchro and digital. Figure 3-3 herein is a typical signal characteristic sheet; Figure 3-4 is an annotated copy. Elements of the signal characteristic sheet are:

a. Title – The military designation and model number of the aircraft analyzed. The particular block of aircraft analyzed within that model is identified in paragraph 1.1 of the handbook.

b. Signal Name – The name of the signal, usually at the origin, as found on TO wiring diagram. In some instances the signal name has been modified for clarity, or abbreviated to fit within the allotted space on the coding



TITLE: PNWD SYSTEM		
AIRCRAFT	DATE	DIAGRAM
T-38A	6-30-76	1 of 1

Figure 3-2. Typical System Block Diagram

T-38A PNWD SIGNAL CHARACTERISTIC SHEET

Signal Name: ILS COURSE DEV R+ **Type:** ANALOG

Description:
INSTRUMENT LANDING SYSTEM COURSE DEVIATION, RIGHT (+)

SIGNAL ROUTING

O	V	D	Equipment	Key	Plug/Pin	References
X			INSTRUMENT LANDING SYSTEM AN/ARN-58	S	P459-R843/M	1T-38A-2-11 P 3-118 E
		X	FLIGHT DIRECTOR SYSTEM	FDCS	P326/Y	
X			INSTRUMENT LANDING SYSTEM AN/ARN-58	S	P459-R843/M	1T-38A-2-11 P 3-118
	X		RADIO INTERCONNECTING BOX	JBA	P1/P P3/-K	1T-38A-2-11 P 3-120
		X	AQU-2/A PILOT'S HSI	HSDP	P145FWD/-U	
X			INSTRUMENT LANDING SYSTEM AN/ARN-58	S	P459-R843/M	1T-38A-2-11 P 3-118
	X		RADIO INTERCONNECTING BOX	JBA	P3/-Q P3/-K	1T-38A-2-11 P 3-120,3-121
		X	AQU-2/A COPILOT'S HSI	HSDC	P145AFT/-U	

LEGEND: O = Origin, V = Via, D = Destination E = T.O. DRAWING ERROR

Figure 3-3. Typical Signal Characteristic Sheet

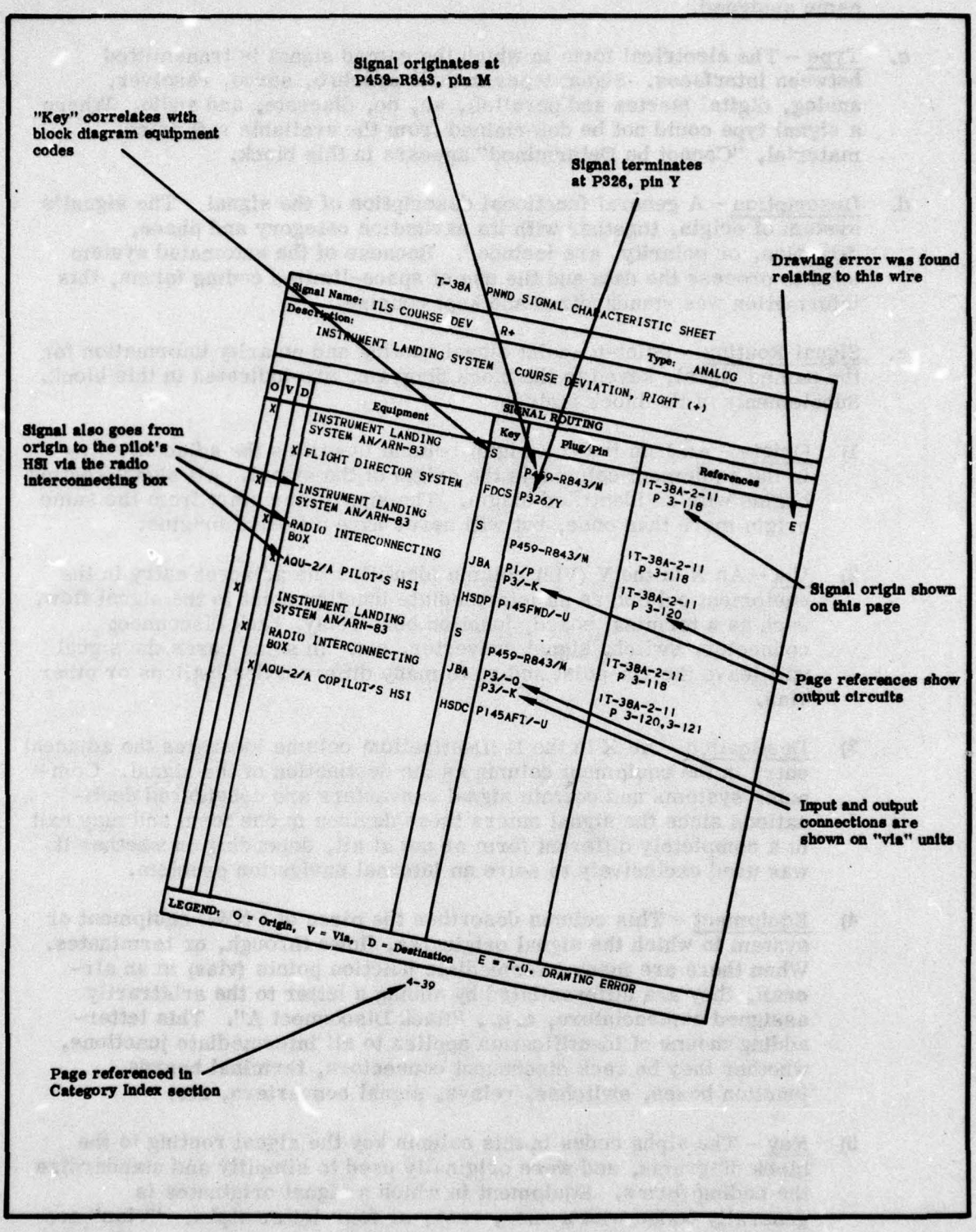


Figure 3-4. Annotated Signal Characteristic Sheet

form. Where no signal name was given on the wiring diagram for the aircraft of interest, diagrams in other TOs were consulted and a functional name assigned.

c. Type – The electrical form in which the named signal is transmitted between interfaces. Signal types include synchro, servo, resolver, analog, digital (series and parallel), ac, dc, discrete, and audio. Where a signal type could not be determined from the available reference material, "Cannot be Determined" appears in this block.

d. Description – A general functional description of the signal. The signal's system of origin, together with its navigation category and phase, direction, or polarity, are included. Because of the automated system used to process the data and the use of space-limited coding forms, this information was standardized and kept concise.

e. Signal Routing – Point-to-point signal routing and polarity information for the named signal, keyed to the block diagram, are indicated in this block. Subelements of the block include:

1) Origin – An X in the O (Origin) column identifies the adjacent entry in the equipment column as the origin of the signal. All signal routing begins with an identified origin. The signal may start from the same origin more than once, but will never have different origins.

2) Via – An X in the V (Via) column identifies the adjacent entry in the equipment column as an intermediate junction point in the signal flow, such as a terminal board, junction box, relay, rack disconnect connector, switch, signal converter, etc. In some cases the signal will leave the via-point and go to many different destinations or other vias.

3) Destination – An X in the D (Destination) column identifies the adjacent entry in the equipment column as the destination of the signal. Computer systems and certain signal converters are considered destinations since the signal enters these devices in one form and may exit in a completely different form or not at all, depending on whether it was used exclusively to solve an internal navigation problem.

4) Equipment – This column describes the piece of PNWD equipment or system in which the signal originates, flows through, or terminates. When there are many intermediate junction points (vias) in an aircraft, they are differentiated by adding a letter to the arbitrarily assigned nomenclature, e.g., "Rack Disconnect A". This letter-adding means of identification applies to all intermediate junctions, whether they be rack disconnect connectors, terminal boards, junction boxes, switches, relays, signal converters, etc.

5) Key – The alpha codes in this column key the signal routing to the block diagrams, and were originally used to simplify and standardize the coding forms. Equipment in which a signal originates is generally coded with a one-, two-, or four-letter alpha. "Vias" are identified with a three-letter code, with the occasional exception that a single letter is used in the third-letter position. Destinations can

be either one-, two-, or four-letter alphas. The letters that make up the alpha code, particularly for signal destinations, are usually the key letters in the equipment name (e.g., BDHP for pilot's bearing distance heading indicator).

6) Plug-Pin – The plug or jack destination taken from the TO wiring diagram is shown as the first entry in this column. The plug or jack designator is followed by a slash and then the pin designator, e.g., P326/Y. In some instances in which a plug or jack was not identified by a designator on the TO wiring diagram, a reference such as a manufacturer's part number, nomenclature, etc., was assigned to help identify it. A pin designation preceded by a dash (-) indicates that the designator appearing on the plug or jack is in lower case letters. Plug/pin designators shown as "vias" have two references, the first identifying the input plug/pin combinations and the second the output combinations.

7) Reference – This column lists the document and page number from which the signal routing data were taken. Destination entries for a signal are not assigned reference numbers since such numbers can be found in the preceding references listed. In some instances a code letter E or U will be located on the right-hand side of this column. The letter E indicates that there is a TO drawing error associated with this entry, and a letter U that signal tracing could not be completed because of insufficient TO data.

f. Legend – The legend at the bottom of the page explains the abbreviations used in the Signal Routing block.

3.5 HANDBOOK SECTION 5 – PNWD SIGNAL CATEGORY INDEX

This section cross-references the PNWD signal characteristic sheets by page number. Signals are grouped alphabetically into functional navigation categories, and then the page number of the signal characteristic sheet on which a desired signal may be found is listed. The index serves as a guide to quickly locate any signal of interest in the signal characteristic sheet section. Figure 3-5 is a typical PNWD Signal Category Index page.

3.6 HANDBOOK SECTION 6 – PNWD EQUIPMENT PHYSICAL CHARACTERISTIC

Physical characteristics of PNWD equipment are listed in Section 6. The equipment is grouped by system type and listed by common part number. In some instances the same piece of equipment, particularly control units and instruments, are used in more than one system and may therefore be listed more than once. Also, when there are several identical pieces of equipment, the quantity is identified in brackets after the nomenclature; however, the weight and dimensions given are applicable to a single unit.

The physical characteristics for each piece of equipment, as illustrated in Figure 3-6, are listed opposite the nomenclature for that equipment. These characteristics include the weight (in pounds) and envelope dimensions (in inches) for the equipment.

T-38A PNWD SIGNAL CATEGORY INDEX

Category	Signal Name	Page
ALTITUDE	ENCODED ALT A1	4-11
	ENCODED ALT A2	4-12
	ENCODED ALT A4	4-13
	ENCODED ALT B1	4-14
	ENCODED ALT B2	4-15
	ENCODED ALT B4	4-16
	ENCODED ALT C1	4-17
	ENCODED ALT C2	4-18
	ENCODED ALT C4	4-19
	ENCODED ALT D2	4-20
	ENCODED ALT D4	4-21
AMBIGUITY	TACAN TO/FROM T+	4-37
	TACAN TO/FROM F+	4-38
BEARING	TACAN BEARING X	4-26
	TACAN BEARING Y	4-27
COURSE	COURSE RESOLVER A	4-1
	COURSE RESOLVER B	4-2
	COURSE RESOLVER C	4-3
	COURSE RESOLVER D	4-4
	COURSE RESOLVER F	4-5
	COURSE RESOLVER A	4-6
	COURSE RESOLVER B	4-7
	COURSE RESOLVER C	4-8

Figure 3-5. Typical PNWD Signal Category Index Page

T-38A PNWD EQUIPMENT PHYSICAL CHARACTERISTICS

SYSTEM	UNIT		WT (LB)	SIZE (IN)		
	TYPE (P/N)	NOMENCLATURE		H	W	D
AN/ARN-65 TACAN System						
	RT-471/ARN-65	Receiver-Transmitter	50	7.688	17.375	9.375
	MT-2091/ARN-65	Mounting	2.25	2.5	17.656	9.563
	C-1763/ARN-21A	Radio Set Control (2 ea)	3	3.0	5.75	5.688
	GF 2147	TACAN Tone Filter	0.25	1.75	1.25	.875
	SA-521A/A	Radio Frequency Transmission Line Switch	0.34	1.94	2.781	3.19
	2334	Antenna (2 ea)	0.4	3.3	1.75	5.25
	AQU-2/A	HSI (2 ea) (part of flight director)	8.5	4.313	5.063	9.5
AN/ARN-58 Instrument Landing System						
	R-843A/ARN-58	Localizer Receiver	7.625*	7.75	6.875	5.593
	R-844/ARN-58	Glideslope-Marker Beacon Receiver	8.625	9.75	6.875	5.015
	37P4	Glideslope Antenna	0.7	5.984	2.0	4.5
	2279	Marker Beacon Antenna		2.70	5.63	12.63
	3-61389	VHF Antenna				
	C-3491/ARN	ILS Control Panel (2 ea)	1.0	2.25	5.75	4.3125
	MS25331-3	Marker Beacon Light (2 ea)	0.06	0.75 diam.		2.250
	AQU-2/A	HSI (2 ea) (part of flight director)	8.5	4.313	5.063	9.5
	ARU-2A/A	ADI (2 ea) (part of flight director)	8.5	5.25	5.0	8.0
	MS25002-4	Mode Switches (part of flight director)	0.5	1.950 diam.		2.9

*Includes mount

Figure 3-6. Typical PNWD Equipment Physical Characteristics Page

3.7 HANDBOOK SECTION 7 – BIBLIOGRAPHY

Reference material used in the preparation of the NEIH is identified in Section 7 of the handbook. The items listed are primarily aircraft and avionics TOs. Military specifications are also listed where appropriate, with applicable change or revision dates. Figure 3-7 presents a typical bibliography page.

T-38A BIBLIOGRAPHY

T.O. Number	Chg/Rev	Title
IT-38A-01	1 Mar 72	List of Applicable Publications - T-38A
IT-38A-1	1 Apr 73	Flight Manual - T-38A
IT-38A-2-9	1 Apr 72	Organizational Maintenance, Instruments - T-38A
IT-38A-2-10	1 Sep 73	Organizational Maintenance, Radio, Communications, and Navigation Systems - T-38A
IT-38A-2-11	25 Apr 74	Organizational Maintenance, Wiring Diagrams - T-38A
5F1-5-4-2	25 Oct 74	Field Maintenance, Integrated Flight Director System for T-38A Aircraft (Bendix)
5F5-4-13-13	1 Jul 74	Overhaul, Altitude Encoding Altitude Transducer Computer, Type CPU-46
5F5-4-13-22	1 May 75	Field Level Checkout Procedures, Altitude Encoding Transducer Altitude Computer, Altitude, Type CPU-46/A
5F5-5-3-2	15 Aug 74	Field Maintenance, Aircraft Flight Director Computer, Type CPU-4/A (Collins)
5N1-2-10-2	25 Oct 74	Field Maintenance, Aircraft Magnetic Gyro Compass, Type J-4, P/N S100-2C (Kearfott)
12R5-2ARN58-2	1 Dec 73	Field Maintenance, Radio Receiving Set, Type AN/ARN-58 (Collins)
12R5-2ARN58-12	25 Jul 75	Field Maintenance, Receiving Set, Radio AN/ARN-58 and AN/ARN-58A
12R5-2ARN65-2	1 Jul 71	Field Maintenance, Radio Set, Type AN/ARN-65 (T-38 Installation) (Hoffman)
MS25002	10 May 1973	Switch, Rotary, 28/115 Volts

Figure 3-7. Typical Bibliography Page

4
CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

As a result of the NEIH development effort, it is concluded that:

a. The conciseness of the material presented in each volume of the NEIH will save the user considerable time otherwise expended in searching through many different documents to obtain the same information. And, where such a search might be needed to obtain further information on a signal of interest, references are readily identified in the NEIH that will help minimize the time needed to locate that information.

b. By providing pertinent PNWD interface data in a single source, integration requirements within the avionics system can be easily determined and compared, thereby promoting interface standardization and aiding the form, fit, and function of new avionics designs.

c. Many different uses may be made of the handbook data, depending upon the interests of the user. Typical applications should include:

- Identifying and tracing signals through PNWD systems
- Determining the configuration of PNWD avionics suites
- Identifying by military nomenclature the equipment included in PNWD systems
- Comparing the physical characteristics of different PNWD equipment
- Determining the functional and/or electrical characteristics of particular signals
- Obtaining other reference material from the sources listed in the bibliography.

d. The NEIH can be useful for purposes other than system integration engineering. For example, maintenance personnel can refer to it to quickly locate and/or trace a troublesome signal in a system; and instructors can use it for aircraft orientation or familiarization courses.

e. Changes to the aircraft avionics suites described in the NEIH will occur on a regular basis, and impact on the accuracy of the handbook data. Therefore, to remain an effective source of PNWD data, the NEIH must be maintained in an accurate and current status.

f. The general methods and procedures developed under this contract can be applied to the production of handbooks for other types of aircraft systems, such as communications, fire control, electrical, etc. In particular, the computer programs developed for automated data processing and handbook production are essentially of a universal nature, and can be applied with few modifications to the production of other types of handbook.

4.2 RECOMMENDATIONS

The following recommendations are offered:

a. The material in each volume of the NEIH should be maintained accurate and current through a combined effort of handbook users and the AFLC maintenance activity. A maintenance plan recommended for implementation is described in this report.

b. Since it is likely that aircraft such as the F-15, F-16, A-10, etc., will have future integration requirements, an NEIH volume should be developed for each of these aircraft. The scope of the NEIH for these aircraft could also be made more comprehensive by including secondary signals, such as those associated with aircraft warning and control. These types of signals are more prevalent in the newer digital systems than in the older analog systems. The NEIH volumes already completed for aircraft such as the F-111 and F-4 should also be expanded to include secondary signals. The only handbook portions significantly affected by such an expansion would be Sections 4 and 5.

c. The PNWD system is only one type of aircraft electronic/electrical system affected by integration requirements. Other systems, such as communications and automatic flight control, have similar interface/integration requirements and could benefit from interface standardization through the use of an integration handbook. The procedures and methods and computer programs developed for the PNWD system data analysis and processing can also be used for these systems with little or no modification to produce other system handbooks.

APPENDIX A
PNWD SIGNAL CODING INSTRUCTIONS

This appendix presents the guidance information used by ARINC Research in coding PNWD signals for computer processing.

A.1 CODING METHOD AND CONVENTIONS

PNWD interface data will be coded in the 80-column format illustrated in Figure A-1. The following coding conventions will apply:

a. All entries will be left-justified

b. 0 = Zero

c. Ø = Alpha O

d. 1 = One

e. I = Alpha I

f. 2 = Two

g. Z = Alpha Z

A.2 CODES

Methods and designations for encoding PNWD interface data are as described below. Column-number references are to the PNWD analysis coding sheet, Figure A-1.

A.2.1 Aircraft Type Coding, Columns 1-3

Each aircraft type of interest will be assigned a three-character alpha code, to be placed in columns 1-3 of the coding sheet. Table A-1 lists these codes.

A.2.2 Signal Name, Columns 4-21

The signal name will be entered in columns 4-21. Signal names will be as found in the applicable TOs, but modified as necessary for clarity and conciseness. Only information relating to pertinent navigation signals – those carrying key PNWD information – will be listed on the coding sheet. Columns 20 and 21 will be used only for entering the signal-name clarification data from Table A-2.

0 = Zero, 1 = One, 2 = Two
ø = Alpha O, 1 = Alpha I, 8 = Alpha Z
–Alpha = Lower Case

ARINC Research Corporation

PNWD INTERFACE DATA

SHEET NO. _____ OF _____

DATE _____

WORK ORDER NO. 1296

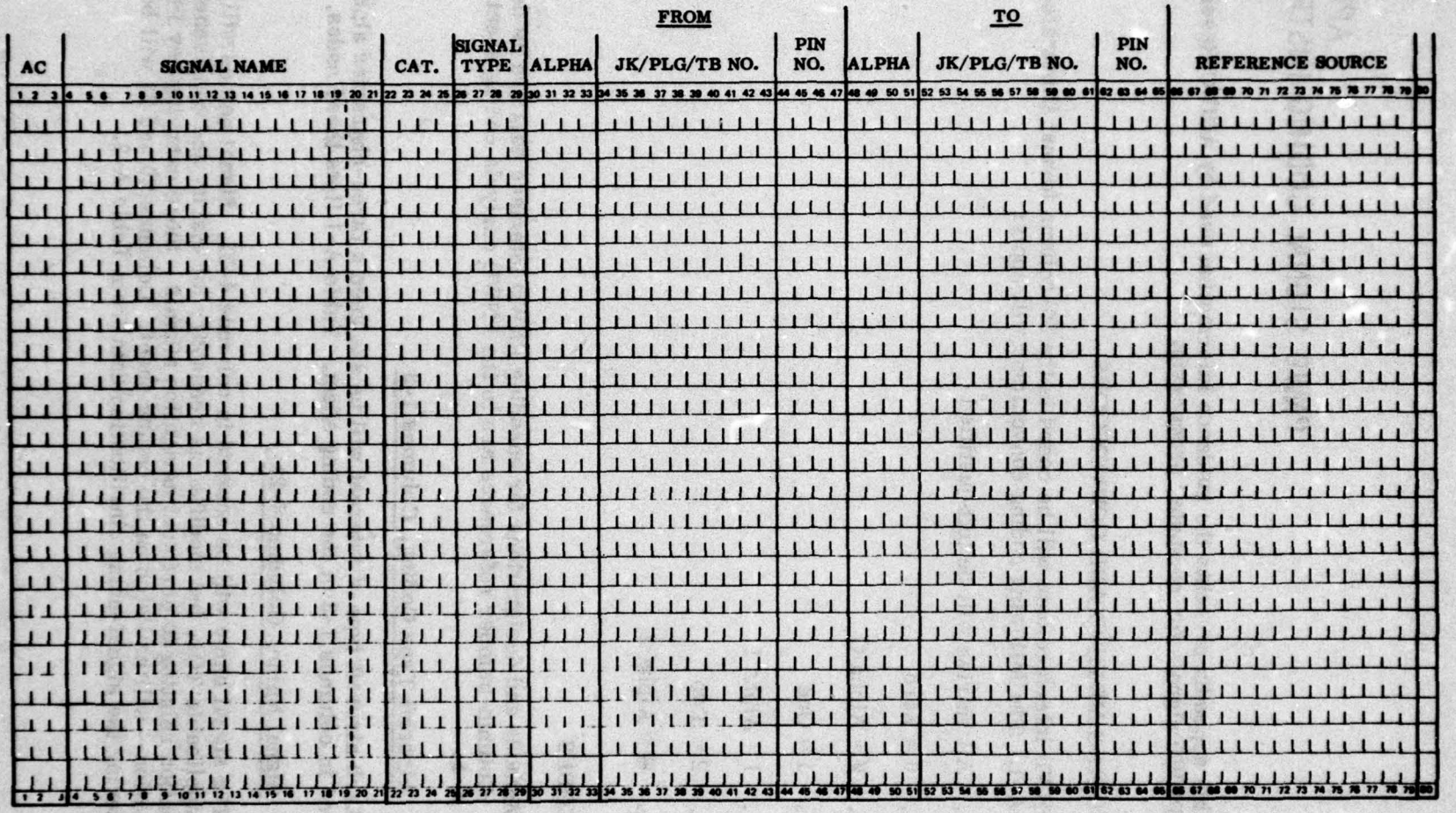


Figure A-1. Example Coding Sheet for PNWD Analysis

TABLE A-1. AIRCRAFT TYPE CODING

Code	Type	Code	Type
AAD	A-7D	FKA	F-106A
BBD	B-52D	FKB	F-106B
BBG	B-52G	FLA	F-111A
BBH	B-52H	FLD	F-111D
CAA	C-5A	FLE	F-111E
CDA	C-9A	FLF	F-111F
CNE	HC-130H	FLZ	FB-111A
CSA	VC-140B	HAT	TH-1
CTA	C-141A	HBF	HH/CH-3E
CQA	C-135A	HGB	HH-53B/C
CQE	EC-135C	LBA	O-2A
CQK	KC-135A	LCA	OV-10A
CQR	RC-135A	TFB	T-37B
CQV	VC-135B	TGA	T-38A
CQW	WC-135B	THA	T-39A
FAE	F-4E	TKA	T-43A
FAR	RF-4C		

TABLE A-2. SIGNAL NAME CLARIFICATION

Clarification Data	Col. 20 Code	Col. 21 Code
Synchro X		X
Synchro Y		Y
Synchro Z		Z
Units, synchro X	U	X
Units, synchro Y	U	Y
Units, synchro Z	U	Z
Tens, synchro X	T	X
Tens, synchro Y	T	Y
Tens, synchro Z	T	Z
Hundreds, synchro X	H	X
Hundreds, synchro Y	H	Y
Hundreds, synchro Z	H	Z
Plus (+)		+
Minus (-)		-
Right (+)	R	+
Left (+) or (-)	L	+ or (-)
To (+)	T	+
From (+) or (-)	F	+ or (-)
Up (+)	U	+
Down (+) or (-)	D	+ or (-)
High level	H	
Low level	L	
Common	C	
Pot wiper (arm)	W	
Resolver leads		A
Resolver leads		B
Resolver leads		C
Resolver leads		D
Resolver leads		E
Resolver leads		F
Resolver leads		G
Resolver leads		H

A.2.3 Signal Category, Columns 22-25

An alpha-character identifier will be entered into columns 22-25 to help identify the navigation system and define the signal category function. Table A-3 lists different navigation systems considered in the PNWD analysis and Table A-4 identifies the signal categories.

Column 22 will contain a code identifying the system type from Table A-3 (e.g., ADF, TACAN, etc.). Column 23 will indicate the number of systems, if more than one system of the same type is used (e.g., ADF No. 1 and ADF No. 2); if there is only one system, column 23 will be left blank. Appearing in columns 24 and 25 will be a code identifying the function from Table A-4 (e.g., bearing, heading, etc.).

A.2.4 Signal Type, Columns 26-29

An alpha-character code corresponding to a signal type described in Table A-5 will be entered in columns 26-29. If the signal type cannot be determined, "CNBD" will be entered.

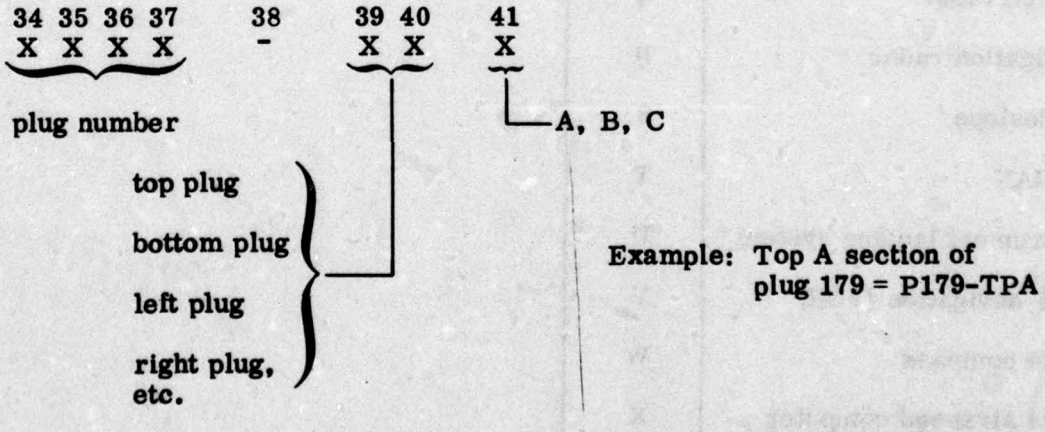
A.2.5 "FROM" Codes

A.2.5.1 System Alpha Code, Columns 30-33

Each box on the system block diagram will be assigned an alpha code indicating the location of the signal being described. The alpha code of the box from which the signal is coming (origin) will be entered in columns 30-33. Table A-6 lists typical alpha codes.

A.2.5.2 Jack/Plug/TB No., Columns 34-43

The jack, plug, or terminal board identified with the signal and the "FROM" alpha location being described will be entered in columns 34-43. When top, bottom, left, or right plug names are indicated, they will be identified as follows:



If the jack, plug, or terminal board cannot be identified by number from available literature, engineering judgment will be applied in determining the entry to be made in these columns. An entry should, at the minimum, be helpful in determining the location of the jack, plug or terminal.

TABLE A-3. PRIMARY NAVIGATION SYSTEMS FOR PNWD ANALYSIS

System Type	Col. 22 Code	Col. 23 Code
Automated direction finder, UHF	A	a. The number of the system described in column 22, i.e.,
Navigation instruments	B	A = System No. 1
Air data computer system	C	B = System No. 2
Doppler	D	C = System No. 3, etc.
Doppler computer	E	Use blank if there is only one system.
VHF/FM	F	b. Type of system:
Radar altimeter, low level	G	P = Primary
Radar altimeter, high level	H	S = Secondary
Navigation computer	J	c. For Course Computer alpha code K, the following apply:
Course computer	K	W = Weapons delivery
LORAN	L	F = Flight director
--	M	
Vertical navigation system	N	
Inertial navigation system	P	
Search radar	Q	
Navigation radar	R	
Glideslope	S	
TACAN	T	
Instrument landing system	U	
VHF navigation (VOR)	V	
Gyro compass	W	
True airspeed computer	X	
Distance measuring equipment	Y	
Automatic direction finder, low frequency	Z	

TABLE A-4. IDENTIFICATION OF SIGNAL CATEGORIES
(Sheet 1 of 2)

Function Type	Col. 24 Code	Col. 25 Code
Altitude	A	
Pressure	A	H, L, M, N, P, Q, W
Pressure, multidigital	A	B
Pressure, encoded	A	C, E, F, G
Absolute	A	A, J
Desired	A	D
Rate of change (vertical speed)	A	R
Bearing	B	
Magnetic	B	M
Relative	B	R, S
True	B	T
Course (Desired Track)	C	
Magnetic	C	M
True	C	T
Grid	C	G
Desired	C	D, E
Deviation	D	
Course (cross track)	D	C, D, R
Vertical (glideslope)	D	V, W, X, Y
Flag (vertical)	D	A, B, E, F, G
Flag (horizontal)	D	H, J
Flag (vert. & horiz.)	D	K
Drift	E	
Angle	E	A, B, C
Velocity	E	U
Azimuth Angle	F	E, N
Ground	G	
Speed	G	S
Track (track angle)	G	T, A
Heading	H	
Desired	H	D, E
Magnetic	H	M, N, P, Q
True	H	T, U
Grid	H	C
Gyro	H	G
Velocity	H	V
Dimensional	H	A
Track Angle Error	J	

TABLE A-4. (Sheet 2 of 2)

Function Type	Col. 24 Code	Col. 25 Code
Position	L	
Latitude	L	A, B,
Longitude	L	N
Marker beacon	L	P
Identification	N	
Ambiguity	Q	
To/from	Q	T
Distance (range)	R	
Slant	R	B, S,
Along track	R	T
Distance-to-go	R	G
Flag	R	F
Rate	R	R
Airspeed	S	
Indicated	S	D, E, F, G
True	S	T, U, V
Mach	S	H, M, N, P
Safe	S	S
Time	T	
Zulu	T	Z
ETA	T	E
Time-to-go	T	G
Dimensional velocity	V	A, B, C, D, E, F, G, H, N, S, W
Wind	W	
Direction	W	D
Speed	W	S

TABLE A-5. IDENTIFICATION OF SIGNAL TYPES

Signal Type	Col. 26-29 Code
AC	AC
Analog	ANA
Audio	AUD
Cannot be determined	CNBD
DC	DC
Digital	DIG
Digital parallel	DIGP
Digital serial	DIGS
Discrete	DISC
Resolver	RES
Servo	SER
Synchro	SYNC

TABLE A-6. TYPICAL ALPHA CODING ASSIGNMENTS

Box Description	Col. 30-33/48-51, Code
PNWD functions	System Type Code of Table 2-2, columns 22 and 23
Bearing, distance, heading indicator	
Pilot's	BDHP
Copilot's	BDHC
Navigator's No. 1	BDHN
Navigator's No. 2	BDHM
Flight director system	
Pilot's (or No. 1)	FDCA
Copilot's (or No. 2)	FDCB
Only one system	FDCS
IFF-SIF system	AIMS
Armament system	ARMS
Automatic flight control system (autopilot)	AFCS
All Weather Landing System	AWLS
Interphone system	CMMM
Indicators	Three-letter identifier followed by P, C, or N. Examples:
Altimeter	ALD_
Radar altimeter	RAD__
DME	DMS__
Navigator's true airspeed	TASN__
Horizontal situation	HSD__
Radio magnetic	RMD__
Course	CDD__
Flight director	FDD__
Instrument selector	
Pilot's	SPA - SPZ
Copilot's	SCA - SCZ
Navigator's	SNA - SNZ
Rack disconnect & test connector	RDA - RDZ*
Terminal strip	TSA - TSZ*
Junction box	JBA - JBZ*
Switch	SWA - SWZ*
Signal converter	CSA - CSZ*

*Excluding I&O

A.2.5.3 Pin No., Columns 44-47

The number of the pin connecting the described FROM signal within the plug, jack, or terminal board will be entered in columns 44-47.

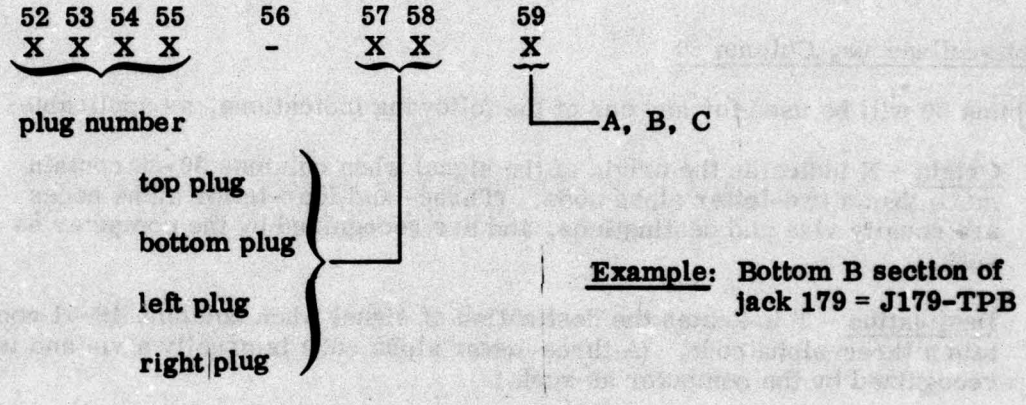
A.2.6 "TO" Codes

A.2.6.1 Assigned Alpha Code, Columns 48-51

Each box on the system block diagram will be assigned an alpha code designating the destination of the signal being described. This code will be entered in columns 48-51. Table A-6 presents typical alpha codes.

A.2.6.2 Jack/Plug/TB No., Columns 52-61

The jack, plug, or terminal board identified with the signal and the "TO" alpha location being described will be entered in columns 52-61. When top, bottom, left, or right plug names are indicated, they will be entered as illustrated below:



If the jack, plug, or terminal number cannot be identified, engineering judgment will be applied in determining the entry made in these columns. An entry should, at the minimum, be helpful in determining the location of the jack, plug, or terminal.

A.2.6.3 Pin No., Columns 62-65

The pin number carrying the described "TO" signal within the plug, jack, or terminal board will be entered in columns 62-65.

A.2.7 Reference Source, Columns 66-79

An alphanumeric code will be entered in columns 66-79 to reference the Technical Order and page number applicable to each line of data. Table A-7 is an example listing of Technical Orders, with an alpha designator identifying each within an aircraft or equipment group. This alpha will be entered first, followed by a comma and the Technical Order page number.

TABLE A-7. EXAMPLE LISTING OF REFERENCE SOURCES (C-141)

A/C Type	A/C Code	T.O. Number	T.O. Title	T.O. Code
C-141	CTA	1C-141A-01	List of Applicable Publications	AA
		1C-141A-1	Flight Manual	AB
		1C-141A-02-6	Organizational Maintenance-Instruments	AC
		1C-141A-02-8	Organizational Maintenance-Radio Communication	AD
		1C-141A-02-11	Organizational Maintenance-Aircraft Wiring Diagrams	AE

A.2.8 Miscellaneous, Column 80

Column 80 will be used for any one of the following indications, as applicable:

a. Origin – X indicates the origin of the signal when columns 30-33 contain more than a two-letter alpha code. (Three- and four-letter alpha codes are usually vias and destinations, and are recognized by the computer as such.)

b. Destination – T indicates the destination of signal when columns 48-51 contain a three-alpha code. (A three-letter alpha code is usually a via and is recognized by the computer as such.)

c. One Line Entry – L indicates that the above rules cannot be applied.

d. Signal Tracing Incomplete – U indicates that signal tracing cannot be completed.

e. Wiring List Error – E indicates an error in the Technical Order wiring list. The correct data will be encoded.

APPENDIX B

REPORT-GENERATION COMPUTER PROGRAMMING REQUIREMENTS SPECIFICATION

B.1 SCOPE

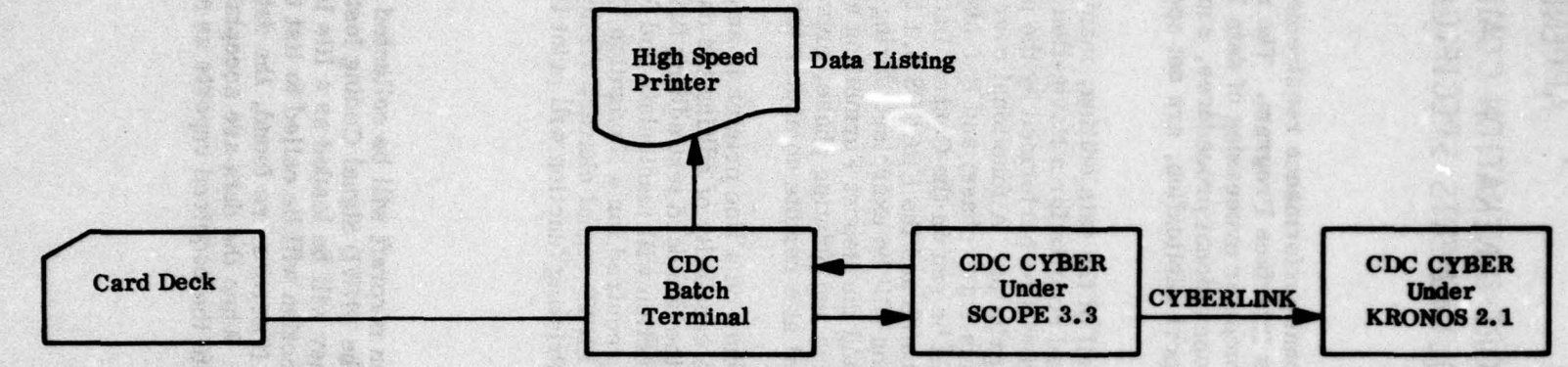
This appendix specifies operational and functional performance requirements for report-generation programs of the Standard Avionics Interface Program. The requirements presented here are only those applicable to computer processing of data for the Navigation Equipment Integration Handbook. Other operational procedures, such as data preparation, data analysis, keypunching, or report publication, are not specified herein.

The report-generation programs will provide all of the data editing, manipulating, and formatting necessary to produce the required reports for a Navigation Equipment Integration Handbook. Three distinct functions will be performed by the programs: data listing, report formatting, and report printing. A functional overview of the processing procedure is shown in Figure B-1 (data entry phase) and B-2 (data manipulation and printing phase). The programs will be run on the Control Data Corporation Cybernet System using the SCOPE 3.3 batch and the KRONOS 2.1 time-sharing operating systems. The Data Listing function will be exercised during the data entry phase, utilizing the SCOPE 3.3 system; and the Report Formatting and Report Printing functions during the data manipulation and printing phase, primarily using the KRONOS 2.1 system under operator control at a remote computer terminal.

The Data Listing function will ouput the input data on a line printer in an easily readable format to expedite review of the data. The capability of editing the data once it has been entered will also be provided as part of the standard text editing function of the computer system. The Report Formatting function will manipulate and format the data so as to produce the three types of reports required for a Navigation Equipment Integration Handbook: PNWD equipment list, PNWD signal characteristic sheets, and PNWD signal category index list. The Report Printing function will print the reports at the remote terminal.

B.2 REQUIREMENTS

Signal data for PNWD electronic systems of an aircraft will be collected and entered onto coding sheets for keypunching, using the PNWD Signal Coding Instructions (Appendix A). Once the signal data are encoded, they will be loaded as a file into the computer system. At that time the Data Listing function will be called to list the data in easily readable format on a high speed printer. If errors are found, the data will be modified using the KRONOS editing capabilities. When the data are acceptable, the Report Formatting function will be called to generate the required reports as a disk file, and the report files will then be printed.



Card deck contains:

1. Control cards for SCOPE processing
   a. Load data into files.
   b. Run data listing function.
   c. Transfer file to KRONOS.
2. Control cards for KRONOS processing
   a. Load data into files.
   b. Sequence data.
3. Input data files
   a. Load signal data.
   b. Load data decode tables.

Terminal inputs card deck for SCOPE 3.3 system, and prints output from separate fields program.

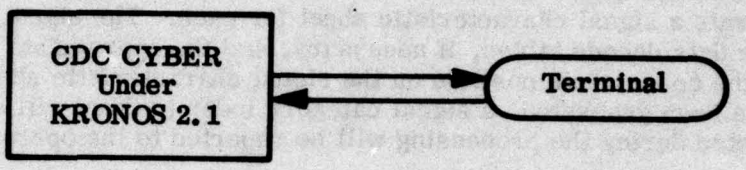
Interprets SCOPE control cards

1. Loads data files.
2. Runs data listing function. Sends output from data listing function. to batch terminals.
3. Transfers KRONOS control cards and data files to KRONOS system over CYBERLINK.

Interprets KRONOS control cards

1. Inputs data files.
2. Sequences data files.

Figure B-1. Functional Overview of Report Generation Processing, Data Entry Phase



Interacts with terminal to SCOPE and performs required processing:

1. Edits data files.
2. Runs signal report formatting function. Outputs errors to terminal.
3. Print reports at terminal to SCOPE, depending on option chosen.

Used for interactive control of processing:

1. Edits data files.
2. Initiate report formatting function. Lists errors from program.
3. Initiate report printing function.

Figure B-2. Functional Overview of Report Generation Processing, Data Manipulation and Printing Phase

B.2.1 General Functional Description

B.2.1.1 Data Listing Function

The Data Listing function will be used as an aid in reviewing a set of raw signal data. The signal data will be input in punched card format into the SCOPE batch operating system. The data will then be automatically validated, to the extent possible, by automatically comparing fields against the data decode tables for that set of signal data. If invalid data are found, the record containing it will be flagged. The raw data will be sequenced and printed, with the fields separated by several spaces for easier readability.

B.2.1.2 Report Formatting Function

The Report Formatting function will be used to generate the specified reports for the handbook. From the signal data, this function will determine all signals in the system and generate a signal characteristic sheet for each. The signal data will be decoded from the data decode tables, if necessary, and the appropriate headings will be generated in the appropriate position on the signal characteristic sheet. When these sheets have been generated, a signal category index to them will be produced. Any errors detected during the processing will be reported to the operator.

B.2.1.3 Report Printing Function

The Report Printing function will print, on the remote computer terminal, the report generated by the Report Formatting function.

B.2.2 Detailed Functional Description

B.2.2.1 Data Listing Function

The following paragraphs describe functional requirements of the Data Listing function.

B.2.2.1.1 Input – Inputs to the Data Listing function from the file system will include:

a. Signal data file (see Figure B-3 for contents and structure)

b. Data decode table file (see Figure B-4 for contents and structure).

B.2.2.1.2 Processing — Processing for the Data Listing function will be as follows. The signal data file and the data decode table file will be input, and the validity checks described below will be made. The data input-output correspondence, as described below, is listed in Table B-1. The table numbers referenced are the assigned decode table numbers listed in Table B-2.

a. The AC field (columns 1-3) of the first signal data record in the file will be compared with the aircraft code fields in decode Table 8 (Aircraft Type Coding) to see if the signal data contains a valid aircraft code. If not, the record will be flagged with a "1". The records in the order entered will be checked against Table 8 until a valid aircraft code is found. Thereafter, the AC fields on all following records will be compared with this code. If the AC field of a record does not compare, that record will be flagged with a "1".

SEQUENCE NUMBER	AIRCRAFT CODE	SIGNAL NAME	CATEGORY

SIGNAL TYPE	FROM ALPHA	FROM JK/PLG/TB NO.	FROM PIN NO.	TO ALPHA

TO JK/PLG/TB NO.	TO PIN NO.	REFERENCE SOURCE	SPECIAL CODE

Figure B-3. Format of Signal Data File

SEQUENCE NUMBER	TABLE IDENTIFIER	AIRCRAFT CODE	ALPHA CODE

ALPHA DECODE INFORMATION

Figure B-4. Format of Data Decode Table File

TABLE B-1. DATA INPUT-OUTPUT CORRESPONDENCE

Signal Characteristic Sheet Heading	Data Decode Tables and Translation Approach	Input Data Coding Form Field
Aircraft Name	Table 8, Aircraft Type Coding; direct decode	"AC" (Aircraft Code), col. 1-3
Signal Name	No decode	"SIGNAL NAME", col. 4-21
Signal Description	Category identifier; append strings as follows:	"CAT" (Signal Category):
	1. Decode col. 24-25 from Function table (5).	Col. 24-25
	2. Decode col. 22 from System table (3).	Col. 22
	3. Decode col. 23 from Number of System table (4).	Col. 23
	4. Decode col. 20-21 from last two col. of Signal Name table (2).	Col. 20-21
Origin or From (also Via)		
1. Equipment Description	Table 1, Alpha Coding; direct decode, may go to two lines. Second line starts in col. 44 of decode record.	"FROM - ALPHA", col. 30-33
2. Plug/Pin	No decode; append strings from input. Use "/" between fields.	"FROM - JK/PLG/TB NO." col. 34-43; "FROM-PIN NO." , col. 44-47
3. Reference	Table 7, Reference Source. Decode 66-67 from table. Insert "," , blank, "P", blank. Append col. 69-79 from input.	"REFERENCE SOURCE", col. 66-67; 69-79 is page number
To (also Via) or destination		
1. Equipment	Table 1, Alpha Coding; direct decode.	"TO - ALPHA", col. 48-51
2. Plug/Pin	No decode; append strings from input. Use "/" between fields.	"TO - JK/PLG/TB NO.", col. 52-61; "TO-PIN NO.", col. 62-65

TABLE B-2. CARD FORMATS FOR DECODE TABLES

Decode Table	Entry	Column Numbers and Data Input	
1	Alpha coding	1-10:	Table identifier ("1")
		11-14:	Alpha code
		21-80:	Corresponding equipment description
2	Last 2 columns of signal name	1-10:	Table identifier ("2")
		11-12:	Code
		21-80:	Decode description
3	System type	1-10:	Table identifier ("3")
		11:	Code for system type
		21-80	System type description
4	System number	1-10:	Table identifier ("4")
		11:	Code for system number ("A", "B",...max.)
		21-30:	System number ("No. 1", "No. 2",...max.)
5	Function type	1-10:	Table identifier ("5")
		11-12:	Code for function type
		21-80	Function type description (must include entire description for each function type)
6	Signal type	1-10:	Table identifier ("6")
		11-14:	Code for signal type
		21-80:	Signal type description
7	Reference source	1-10:	Table identifier ("7")
		11-12:	Code for reference
		21-80:	Reference description
8	Aircraft type coding	1-10:	Table identifier ("8")
		11-13:	Code for aircraft type
		21-35:	Aircraft type (maximum 16 characters)
9	Signal category	1-10:	Table identifier ("9")
		11:	Code for category
		21-40:	Signal description (maximum 20 characters)

b. The last two columns (20-21) of the Signal Name field on each data record will be compared with the codes in Table 2 to verify that the field contains a valid code. If an invalid field is found, the record will be flagged with a "2".

c. The first column (22) of the Category field for each data record will be compared with the codes in Table 3, "System Type", to verify that the field contains a valid code. If an invalid field is found, the record will be flagged with a "3".

d. The second column (23) of the Category field for each data record will be compared with the codes in Table 4, "System Number", to verify that the field contains a valid code. If an invalid field is found, the record will be flagged with a "4".

e. The last two columns (24-25) of the Category field for each data record will be compared with the codes in Table 5, "Functions", to verify that the field contains a valid code. If an invalid field is found, the record will be flagged with a "5".

f. The Signal Type field (columns 26-29) for each data record will be compared with the codes in Table 6, "Signal Type", to verify that the field contains a valid code. If an invalid field is found, the record will be flagged with a "6".

g. The Alpha fields (columns 30-33 and 48-51) for each record will be compared with the codes in Table 1 to verify that the fields contain valid codes. If either field contains an invalid code, the record will be flagged with an "8".

h. Column 24 of the Category field for each record will be compared to the codes in Table 9 to verify that the field contains a valid code. If an invalid field is found, the record will be flagged with a "9".

A maximum of three errors per record will be flagged.

The signal data will then be printed. In the first five columns of the printout will be a sequence number that will later be used for editing the data. The signal data, as input on the punched cards, will follow with a field separation of three blank spaces between the fields. The last three columns of the line will contain any error flags generated during validation.

After the signal data are output, the data decode tables will be printed. In the first five columns of the printout will be a sequence number that will later be used for editing. The data decode tables will be printed exactly as the data appear on the input cards.

B.2.2.1.3 Output – The output of the Data Listing function to the high-speed line printer will include:

a. Sequenced and expanded signal data with error flags

b. Sequenced data decode tables.

B.2.2.2 Report Formatting Function

B.2.2.2.1 Input – Inputs to the Report Formatting function from the file system will include:

a. Signal data file (see Figure B-3 for contents and structure)

b. Data decode tables file (see Figure B-4 for contents and structure).

B.2.2.2.2 Processing – The signal data file, together with the data decode tables, will be used to generate signal characteristic sheets for each signal, and a signal category index of all signals identified in the input file. Any errors discovered during the processing will be reported to the operator. The format of the signal characteristic sheets will be as shown in Figure B-5, and the signal category index as shown in Figure B-6.

B.2.2.2.2.1 Signal Characteristic Sheets – Signal data will be separated into groups pertaining to individual signals, and a characteristic sheet will be generated for each signal. (The characters in columns 20-25 will uniquely define a signal; this will be the criterion for separating the data into groups.) As the sheets are formatted, the data will be stored in a file that can later be printed. The data on the sheets will be formatted as follows:

a. The aircraft name will be produced from the first valid input record in the signal data file using the data decode tables as defined in the data input-output correspondence table (B-1). This name will be included in the title line on all signal characteristic sheets generated for the report.

b. The signal name will be extracted from the data record containing information about the signal's origin. If the origin record cannot be determined, an error will be indicated (see para. B.2.2.2.2.3) and all processing for the signal will be terminated.

c. The signal type data will be generated from the data record containing information about the signal's origin, using the data decode tables as defined Table B-2. If the data cannot be decoded, an error will be indicated (see para. B.2.2.2.2.3).

d. The signal description will be generated from the data record containing information about the signal's origin, using the data decode tables as defined in Table B-2. If the data cannot be decoded, an error will be indicated (see para. B.2.2.2.2.3) and all processing for the signal will be terminated. Also, if the last character in any record for the signal is a "U" or an "E", one of the following will be written in the Legend block at the bottom of the page: "SIGNAL TRACING INCOMPLETE" or "T.O. DRAWING ERROR".

e. The signal routing information for a signal characteristic sheet will be generated as follows. First, data for the signal will be analyzed to determine all routing paths in the signal's network. Any inconsistencies or errors discovered will be so indicated (see para. B.2.2.2.2.3), and all processing for this signal will be terminated. For each path from

T-38A PNWD SIGNAL CHARACTERISTIC SHEET

Signal Name: ILS COURSE DEV R+ **Type:** ANALOG

Description:
INSTRUMENT LANDING SYSTEM COURSE DEVIATION, RIGHT (+)

SIGNAL ROUTING

O	V	D	Equipment	Key	Plug/Pin	References
X			INSTRUMENT LANDING SYSTEM AN/ARN-58	S	P459-R843/M	1T-38A-2-11 P 3-118 E
		X	FLIGHT DIRECTOR SYSTEM	FDCS	P326/Y	
X			INSTRUMENT LANDING SYSTEM AN/ARN-58	S	P459-R843/M	1T-38A-2-11 P 3-118
	X		RADIO INTERCONNECTING BOX	JBA	P1/P P3/-K	1T-38A-2-11 P 3-120
		X	AQU-2/A PILOT'S HSI	HSDP	P145FWD/-U	
X			INSTRUMENT LANDING SYSTEM AN/ARN-58	S	P459-R843/M	1T-38A-2-11 P 3-118
	X		RADIO INTERCONNECTING BOX	JBA	P3/-Q P3/-K	1T-38A-2-11 P 3-120,3-121
		X	AQU-2/A COPILOT'S HSI	HSDC	P145AF1/-U	

LEGEND: O = Origin, V = Via, D = Destination E = T.O. DRAWING ERROR

Figure B-5. Format of PNWD Signal Characteristic Sheet

T-38A PNWD SIGNAL CATEGORY INDEX

Category	Signal Name		Page
ALTITUDE	ENCODED ALT	A1	4-11
	ENCODED ALT	A2	4-12
	ENCODED ALT	A4	4-13
	ENCODED ALT	B1	4-14
	ENCODED ALT	B2	4-15
	ENCODED ALT	B4	4-16
	ENCODED ALT	C1	4-17
	ENCODED ALT	C2	4-18
	ENCODED ALT	C4	4-19
	ENCODED ALT	D2	4-20
	ENCODED ALT	D4	4-21
AMBIGUITY	TACAN TO/FROM	T+	4-37
	TACAN TO/FROM	F+	4-38
BEARING	TACAN BEARING	X	4-26
	TACAN BEARING	Y	4-27
COURSE	COURSE RESOLVER	A	4-1
	COURSE RESOLVER	B	4-2
	COURSE RESOLVER	C	4-3
	COURSE RESOLVER	D	4-4
	COURSE RESOLVER	F	4-5
	COURSE RESOLVER	A	4-6
	COURSE RESOLVER	B	4-7
	COURSE RESOLVER	C	4-8

Figure B-6. Format of PNWD Signal Category Index

the origin to a destination, the following information will be assembled to fit the specified output page format (see Figure B-5):

1) Origin: Origin identifier, equipment description, alpha key, plug/pin reference.

2) Intermediate equipment in path: "Via" identifier, equipment description, alpha key, input plug/pin, reference. On the next line of the signal routing only the "via" output plug/pin for the equipment will be shown.

3) Destination: Destination identifier, equipment description, alpha key, plug/pin.

Rules for decoding of data are presented in Table B-1. An equipment description can be continued on a second line, but that line will contain no other information. A blank line will separate each line of routing data.

f. Signal routing information may be continued on additional sheets. Those sheets will repeat all heading information (title, signal name, type, and description).

g. Each signal characteristic sheet will be paginated (4-1, 4-2, etc.), with the number centered on the bottom line of the page.

B.2.2.2.2.2 Signal Category Index – A signal category index will be generated to the format illustrated in Figure B-6. The title will contain the same aircraft name as on the signal characteristic sheets. Signals will be ordered by category, which will be determined by decoding column 24 of the signal data using Data Decode Table No. 9.

The first column of the signal category index will contain the signal categories; the second column, all signal names belonging to a category; and the third column, the page number of the signal characteristic sheet corresponding to the signal named in the second column.

The signal category index may be continued on more than one page. Each page of the index will be paginated (5-1, 5-2, etc.), with that number centered at the bottom.

B.2.2.2.2.3 Error Reporting – The operator will be notified at his terminal of any errors detected during the formatting of the report. Errors will be reported when the processing of the report formatting has been terminated. If an error is reported, the data will not have been completely formatted. However, depending on the type of error, portions of the report may have been generated. The individual error descriptions below specify how much of the report is affected by the error. The operator may wish to print the completed parts in order to review the data content before repeating the Signal Report Generation program. If an error is reported, some part of the input data – either signal data or data decode tables – will have to be corrected before a complete report can be generated.

Following is a list of formatting errors, with their causes, their format at the terminal, and their effect on the total report. All such errors will be reported.

a. Aircraft code not found in table – If the AC field on any signal data record contains an invalid aircraft code, the program will be terminated before any parts of the report are printed. The error must be corrected in the signal data table or data decode table before program processing can proceed. The error report format will be "INVALID AIRCRAFT CODE".

b. Origin data record not found – If the record containing data about the origin of a signal cannot be determined for a group of data records pertaining to a signal, processing of that signal will be terminated but will continue for all other signals. A signal characteristic sheet for this signal will not be generated, nor will it be included in the signal category index.

c. Signal type not found in tables – If the record containing data about a signal's origin does not contain a valid "Type" field, processing of that signal will be terminated but will continue for all other signals. A characteristic sheet will not be generated for the signal, nor will it be included in the signal category index. The error report format is "INVALID SIGNAL TYPE FOR SIGNAL XXX, DATA RECORD YYY", where XXX is the unique identifier for the signal, found in columns 20-25 of the signal data record; and YYY is the signal data record's sequence number, to be used for data editing.

d. Signal description not found in tables – If the record containing data about a signal's origin does not contain a valid set of codes for the signal description, processing of that signal will be terminated but will continue for all other signals. A characteristic sheet for the signal will not be generated, nor will it be included in the signal category index. The error report format is "INVALID SIGNAL DESCRIPTION CODES FOR SIGNAL XXX, DATA RECORD YYY", where XXX is the unique identifier for the signal, found in columns 20-25, and YYY is the signal data record sequence number to be used for data editing.

e. Inconsistent signal network – Inconsistencies noted in a signal's network during analysis will cause termination of processing for the signal, but not for other signals. A signal characteristic sheet will not be generated for the signal, nor will it be included in the signal category index. The error report format is "INCONSISTENT SIGNAL NETWORK FOR SIGNAL XXX", where XXX is the unique identifier for the signal found in columns 20-25 of the signal data record.

f. Equipment data code not found in tables – If either the alpha key code or reference code from a signal data record is not found in the data decode tables, the field on the characteristic sheet corresponding to the data in error will be left blank. The error will not cause termination of processing for the signal. The error report format is "INVALID ALPHA CODE FOR SIGNAL XXX, DATA RECORD YYY", or "INVALID REFERENCE CODE FOR SIGNAL XXX, DATA RECORD YYY", where XXX and YYY are as defined above.

g. Invalid category field – If the record containing data about a signal origin does not contain a valid category code in column 24, the signal will not be included in the signal category index. Processing of the signal will not be terminated. The error report format is "INVALID CATEGORY FIELD FOR SIGNAL XXX", where XXX is as identified above.

B.2.2.2.3 Output – The output from the Error Reporting function includes:

a. To file system – Reports print file (see Figures B-5 and B-6 for contents and format)

b. To terminal – Error reports.

B.2.2.3 Report Printing Function

B.2.2.3.1 Input – The input to the Report Printing function will include the following:

a. From file system – Reports print file (see Figures B-5 and B-6 for contents and format)

b. From terminal – Data processing instructions (see Appendix D).

B.2.2.3.2 Processing – The report forms will be inserted into the terminal printer and the report printed as described in Appendix D. The existing KRONOS edit program will be used to select and print segments of report file when necessary.

B.2.2.3.3 Output – The output to the terminal is the report file.

APPENDIX C

STANDARD AVIONICS INTERFACE PROGRAM COMPUTER PROGRAM LISTINGS

		Page
C.1	EQUIP Computer Program	C-3
C.2	GROUPER Computer Program	C-9
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C.4	REPORT Computer Program	C-17

APPENDIX C.1

EQUIP Computer Program

```
PROGRAM    EQUIP

00100 REM EQUIPMENT LISTING PROGRAM
00105 BASE 1
00110 DIM A$(9,140),P$(70)
00112 DIM T$(30)
00113 DIM Z$(4,120)
00120 READ R1,R2,R3,R4,R5
00130 DATA 1,20,5,7,11
00140 REM SET UP FILES
00150 PRINT "WHICH DECODE FILE?"
00160 INPUT F$
00170 PRINT "WHICH OUTPUT FILE?"
00180 INPUT E$
00190 FILE #1:F$,#2:E$
00200 REM INITIALIZE INDICES
00210 P1=1
00212 A1=A2=T1=T3=K3=F5=0
00213 S=K=0
00214 Z2=1
215 T$(1)=" "
00221 T$(2)="A"
00222 T$(3)="B"
00223 T$(4)="C"
00224 T$(5)="D"
00225 T$(6)="E"
00226 T$(7)="F"
00227 T$(8)="G"
00228 T$(9)="H"
00229 T$(10)="I"
00230 T$(11)="J"
00231 T$(12)="K"
00232 T$(13)="L"
00233 T$(14)="M"
00234 T$(15)="N"
00235 T$(16)="O"
00236 T$(17)="P"
00237 T$(18)="Q"
00238 T$(19)="R"
00239 T$(20)="S"
00240 T$(21)="T"
00241 T$(22)="U"
00242 T$(23)="V"
00243 T$(24)="W"
00244 T$(25)="X"
00245 T$(26)="Y"
00246 T$(27)="Z"
00248 DELIMIT #1,($)
00250 NODATA #1, 900
00260 T1=T1+1
```

EQUIP Program (Cont'd)

```
00270 A1=A1+1
00280 INPUT #1,A$(T1,A1)
00290 NODATA #1,350
00300 C$=SUBSTR(A$(T1,A1),1,4)
00305F5=VAL(C$)
00310 IF F5=T1 THEN 00270
00320 A$(T1+1,1)=A$(T1,A1)
00325 IF T1=1 THEN 337
00330 A1=1
00335 GOTO 260
00337 A2=A1-1
00340 GOTO 330
00350 PRINT A2;" ALPHA ITEMS INPUT"
00360 U$=SUBSTR(A$(8,1),21,8)
00362 GOSUB 01010
00365 FOR N5=1 TO 66
00370 P$(N5)="     "
00375 SUBSTR(P$(N5),1,1)=""
00380 NEXT N5
00390 V$=U$+" PNWD EQUIPMENT LIST"
00400 REM PUT TITLE IN PAGE ARRAY
00410 SUBSTR (P$(R1),R2)=V$
00420 C5=57
00430 I$="3"
00440 REM PUT COLUMN HEADINGS IN PAGE ARRAY
00450 H$="   KEY                              EQUIPMENT/UNIT"
00460 SUBSTR(P$(R3),R4)=H$
00470 K1=1
00480 J1=R3+1
00490 FOR T5=K1 TO A2
00492 IF SUBSTR(Z$(4,T5),11,1)=" " THEN 590
00495 REM EXTRACT KEY AND EQUIP NAME
00500 B$=SUBSTR(Z$(4,T5),11,4)
00510 D$=SUBSTR(Z$(4,T5),21,22)
00520 G$=SUBSTR(Z$(4,T5),44)
00530 GOSUB 820
00532 S$="          "
00540 J$=D$+G$+S$
00550 J1=J1+2
00560 SUBSTR(P$(J1),10,4)=B$
00570 SUBSTR(P$(J1),25)=J$
00580 IF J1=>52 THEN 605
00590 NEXT T5
00605 REM INSERT PAGE NUMBER
00610 P2=-P1
00620 M$=STR$(P2)
00630 F4=LEN(M$)+2
00640 SUBSTR(P$(C5),35,F4)=I$+M$
00645 MARGIN #2,80
00650 FOR I=1 TO 66
```

EQUIP Program (Cont'd)

```
00660 PRINT #2,P$(I)
00670 NEXT I
00680 GOSUB 760
00690 P1=P1+1
00695 IF T5<A2 THEN 892
00700 PRINT " EQUIPMENT LIST COMPLETE"
00710 PRINT P1-1;" SHEETS WRITTEN"
00720 N$= "REP,"+E$
00730 CLOSE#2: N$
00740 PRINT "REPORT PAGES IN FILE ";E$
00750 STOP
00760 REM CLEAR SIGNAL ROUTING, LEGEND AND PAGE NUMBER
00770 FOR I=6 TO 66
00780 P$(I)= "      "
00790 SUBSTR(P$(I),1,1)=""
00800 NEXT I
00810 RETURN
00820 T2=LEN(D$)
00830 IF SUBSTR(D$,T2,1)=" " THEN 850
00840 GOTO 880
00850 T2=T2-1
00860 IF T2<>0 THEN 830
00870 D$=SUBSTR(D$,1,T2)
00875 GOTO 885
00880 IF SUBSTR(D$,T2,1)<>"-" THEN 870
00881 D$=SUBSTR(D$,1,T2-1)
00882 GOTO 890
00885 IF SUBSTR(D$,T2,1)="/" THEN 890
00887 D$=D$+" "
00890 RETURN
00892 J1=R3+1
00893 GOTO 590
00900 PRINT "NO DATA IN DECODE FILE"
01000 STOP
01010 T3=T3+1
01015 IF T3>27 THEN 1070
01020 FOR G3=1 TO A2
01030 IF SUBSTR(A$(1,G3),11,1)=T$(T3) THEN 1050
01040 NEXT G3
01045 GOTO 1010
01050 K=K+1
01055 Z$(1,K)=A$(1,G3)
01060 IF G3 <A2 THEN 1040
01065 IF K=>A2 THEN 1070
01066 GO TO 1010
01070 L=1
01072 K=0
01075 Y=T7=1
01077 Z4=11+Z2
01080 IF L=>A2 THEN 1090
```

EQUIP Program (Cont'd)

```
01085 IF SUBSTR(Z$(Z2,L),11,Z2)=SUBSTR(Z$(Z2,L+1),11,Z2) THEN 1150
01087 IF Y=1 THEN 1180
01090 FOR G5=L-Y+1 TO L
01095 IF SUBSTR(Z$(Z2,G5),Z4,1)<>T$(T7) THEN 1110
01100 K=K+1
01105 Z$(Z2+1,K)=Z$(Z2,G5)
01107 IF K>=A2 THEN 1160
01110 NEXT G5
01115 IF T7<27 THEN 1140
01118 IF L>=A2 THEN 1160
01120 Y=T7=1
01125 IF L>=A2 THEN 1160
01130 L=L+1
01135 GOTO 1080
01140 T7=T7+1
01145 GOTO 1090
01150 Y=Y+1
01155 L=L+1
01157 GOTO 1080
01160 Z2=Z2+1
01165 IF Z2>3 THEN 1175
01170 GOTO 1070
01175 RETURN
01180 K=K+1
01185 Z$(Z2+1,K)=Z$(Z2,L)
01187 Y=1
01190 GOTO 1130
01200 END
```

APPENDIX C.2

GROUPER Computer Program

GROUPER Program

PROGRAM GROUPER

```
00100 PROGRAM GROUPER(INPUT,OUTPUT,TAPE3,TAPE5)
00110C      SORTDATA INTO SIGNAL GROUPS
00120 INTEGER KEY(1500),DRC,DRI(1500),UDR(1500)
00130 INTEGER ODRC,GRPID
00140 LOGICAL NXTPAS
00150 DIMENSION L1(1500),L2(1500),L3(1500),L4(1500),L5(1500),L6(1500)
00160 DIMENSION L7(1500),L8(1500),L9(1500)
00170 PRINT,*STARTING*
00180C       GET DATA FILE
00185 PRINT,*WHAT DATA FILE*
00186 READ,IFILE
187 PRINT,*WHAT OUTPUT FILE*
188 READ,JFILE
00190 CALL GET (5HTAPE3,IFILE,0,0)
00200C       SET INPUT DATA RECORD COUNT, OUTPUT DATA RECORD COUNT AND
00210C        UNUSED DATA RECORD POINTER TO ZERO
00220 DRC=0
00230 I=0
00240 ODRC=0
00250 DATA UDR/1500*0/
00260C      REPEAT
00270 1  I=I+1
00280C           INPUT DATA RECORDS
00290C           INCREMENT INPUT DATA RECORD COUNT
00300 READ (3,900) L9(I),L1(I),L2(I),KEY(I),L3(I),L4(I),L5(I),L6(I),L7(I),L
00310 900 FORMAT (A6,A10,A9,A6,5A10,A6)
00330 IF (EOF,3) 2,1
00340 2 DRC=I
00350C      SET START OF NEXT PASS DATA RECORD INDEX TO FIRST DATA ENTRY
00360 DRI=1
00370C      REPEAT
00380C           SET UNSORTED DATA INDEX TO START OF NEXT PASS DATA RECORDIN
00390 3 UDI=DRI
00410C      SET START OF NEXT PASS FOUND INDICATOR FALSE
00420 NXTPAS=.FALSE.
00430C           REPEAT
00440C                INCREMENT UNSORTED DATA INDEX
00445 I=0
00450 DO 10 J=1,1500
00455 I=I+1
00460C           UNTIL UNSORTED DATA RECORD IS UNUSED
00470 IF (UDR(J).EQ.0) GOTO 20
00480 10 CONTINUE
00490C           REPEAT
00500C                SET GOUP ID TO SIGNAL IDENTIFIER FROM DATA RECORD
00510 20 GRPID=KEY(I)
00530 WRITE (5,901) L9(I),L1(I),L2(I),KEY(I),L3(I),L4(I),L5(I),L6(I),L7(I),
00540 901 FORMAT (1H",A6,A10,A9,A6,3H",",5A10,A6,1H")
```

GROUPER Program (Cont'd)

```
00550C INCREMENT OUTPUT DATA RECORD COUNT
00560 ODRC=ODRC+1
00570C                  SET UNSORTED DATA RECORD USED
00580 UDR(I)=1
00590C                  INCREMENT UNSORTED DATAINDEX
00600 25 UDI=UDI+1
00610 I=UDI
00620C                  IF UNSORTED DATA RECORD IS UNUSED THEN
00630 IF(UDR(I).EQ.1) GOTO 40
00640C                       IF UNSORTED DATA RECORD SIGNAL IDENTIFIER IS
00650C                        THE SAME AS GROUP ID THEN
00660 IF (KEY(I).NE.GRPID) GOTO 30
00680 WRITE (5,902)L9(I),L1(I),L2(I),KEY(I),L3(I),L4(I),L5(I),L6(I),L7(I),L
00690 902 FORMAT (1H",A6,A10,A9,A6,3H",",5A10,A6,1H")
00700C INCREMENT OUTPUT DATA RECORD COUNT
00710 ODRC=ODRC+1
00720C                            SET UNSORTED DATA RECORD USED
00730 UDR(I)=1
00740 GOTO 50
00750C                       ELSE
00760C                            SET START OF NEXT PASS FOUND INDICATOR TRUE
00770C                  (ELSE)
00780 30 NXTPAS=.TRUE.
00790 GOTO 50
00800C                  IF START OF NEXT PASS FOUND INDICATOR FALSE THEN
00810 40 IF (NXTPAS) 50,41
00820C                       SET START OF NEXT PASS DATA RECORD INDEX
00830C                        TO UNSORTED DATA INDEX
00840C                  (ELSE)
00850 41 DRI=UDI
00860C            UNTIL UNSORTED DATA INDEX EQUALS INPUT DATA RECORD COUNT
00870 50 IF (UDI.NE.DRC) GOTO 25
00880C      UNTILOUTPUTT DATA RECORD COUNT EQUALS INPUT DATA RECORD COUNT
00890 IF(ODRC.NE.DRC) GO TO 3
00895 ENDFILE 5
00900 CALL REPLACE(5HTAPE5,JFILE,0,0)
00905 STOP
00910 END
```

APPENDIX C.3

SORTER Computer Program

SORTER Program

```
PROGRAM    SORTER

100 REM SAIP SORTING PROGRAM
110 DIM R$(2,200),T$(2)
115 DIM T(200)
200 PRINT "WHICH INPUT FILE TO SORT"
210 INPUT D$
220 PRINT "WHICH OUTPUT FILE"
230 INPUT E$
240 FILE #1:D$,#2:E$
260 X1=0
300 INPUT #1,T$(1),T$(2)
305 R$(1,1)=T$(1)
306 R$(2,1)=T$(2)
310 U$=SUBSTR(R$(1,1),26,6)
320 N2=0
330 N2=N2+1
340 INPUT #1,T$(1),T$(2)
350 NODATA #1, 395
360 IF SUBSTR(T$(1),26,6)<>U$ THEN 400
370 R$(1,N2+1) = T$(1)
380 R$(2,N2+1) = T$(2)
390 GOTO 330
395 X1=1
400 FOR I=1TO200
410 T(I)=0
420 NEXT I
490 ON ERROR THEN 950
500 FOR I=1TON2
510 IF T(I)=0 THEN 530
520 NEXT I
530 T5=I
590 REM SEPARATE DESTINATION FROM VIA
600 IF SUBSTR(R$(2,T5),25,1)=" " THEN 800
610 IF SUBSTR(R$(2,T5),26,1)<>" " THEN 800
620 IF SUBSTR(R$(2,T5),55,1)="T" THEN 800
630 IF SUBSTR(R$(2,T5),55,1)="L" THEN 800
640 REM VIA
650 T(T5)=1
660 V$=SUBSTR(R$(2,T5),23,4)
665 T4=T5
670 PRINT #2,R$(1,T5):"$":R$(2,T5)
690 REM SEARCH FOR VIA
700 T5=T5+1
705 IF T(T5)=1 THEN 700
710 IF V$=SUBSTR(R$(2,T5),5,4) THEN 600
720 IF T5<N2 THEN 700
730 PRINT "SORTING ERROR IN ";V$
735 PRINT SUBSTR(R$(1,T4),1,28)
740 GO TO 305
```

SORTER Program (Cont'd)

```
790 REM DESTINATION
800 T(T5)=1
810 PRINT #2,R$(1,T5);"$";R$(2,T5)
820 IF T5<N2 THEN 500
830 IF X1=0 THEN 305
890 PRINT "SORTING COMPLETE"
900 K$="REP,"+E$
910 CLOSE #2;K$
920 PRINT "SORTED FILE READY FOR REPORT IN FILE ";E$
930 STOP
950 PRINT "ERROR";ESM(X);" AT PROGRAM LINE ";ESL(X)
955 PRINT R$(1,T4)
960 PRINT "PROCEED";
970 INPUT G$
980 IF G$<>"YES" THEN 995
990 JUMP NXL(ESL(X))
995 STOP
1000;"31#","49#"
9999 END
```

APPENDIX C.4

REPORT Computer Program

REPORT Program

```
PROGRAM   REPORT

100 REM SAIP REPORT GENERATION PROGRAM
199 REM DIMENSION ARRAYS
200 DIM R$(2,100),P$(100),N$(10),T$(2)
210 DIM A$(9,140)
220 DIM C(2,500),D(2,500)
440 READ R1,R2,R3,R4,R5,R6,R7,R8,R9
450 DATA 18,12,57,5,7,66,1,4,75
499 REM INITIALIZE CONSTANTS
520 READ S1,S2,S3,S4,S5,S6,S7,S8,S9
530 DATA 15,1,3,32,7,53,74,55,44
590 READ U1,U2,U3,U4,U5,U6,U7,U8
600 DATA 37,5,7,10,30,61,55,35
700 REM SET UP FILES
705 ON ERROR THEN 710
710 PRINT "WHICH INPUT FILE"
720 INPUT D$
730 PRINT "WHICH OUTPUT FILE"
740 INPUT E$
750 PRINT "WHICH DECODE FILE"
760 INPUT F$
770 FILE #1:D$,#2:F$,#3:E$
775 FILE #4="CROSIND",#5="SORT"
776 DELIMIT #4,($),(CR)
998 REM GENERATE REPORTS
999 REM INITIALIZE INDICIES   PAGE COUNTS
1000 K5=0
1010 X1=0
1015 C1=1
1020 P1=1
1030 P2=2
1035 ON ERROR THEN 9400
1040  REM INPUT DATA DECODE TABLES
1045 DELIMIT #2, ($)
1050 NODATA#2,1120
1060  T1=A1=A2=0
1070  T1=T1+1
1080  A1=A1+1
1090  INPUT #2,A$(T1,A1)
1095 NODATA #2,1120
1100 C$=SUBSTR(A$(T1,A1),1,4)
1103 F5=VAL(C$)
1105 IF F5=T1 THEN 1080
1106 A$(T1+1,1)=A$(T1,A1)
1107 A2=A2+A1
1108 A1=1
1110  GOTO 1070
1120  PRINT T1;" DECODE TABLES, ";A2;" ITEMS INPUT"
1400 REM INPUT FIRST DATA RECORD FROM SORTED SIGNAL DATA FILE
```

REPORT Program (Cont'd)

```
1410 PRINT "CHARACTERISTIC SHEETS PROCESSED AS NUMBER IS PRINTED:"
1415 DELIMIT #1,($)
1420 INPUT #1,T$(1),T$(2)
1430 REM IF AIRCRAFT NAME VALID THEN
1440 S$=SUBSTR(T$(1),7,3)
1445 Y$=S$
1450 T1=8
1460 GOSUB 7010
1470 IF V1<>0 THEN 6999
1475 V$=U$+"  PMMD SIGNAL CHARACTERISTIC SHEET"
1480 REM REPEAT FOR EACH SIGNAL GROUP
1490 REM MOVE LAST RECORD INPUT TO BEGINNING OF INPUT AREA
1500 R$(1,1)=T$(1)
1510 R$(2,1)=T$(2)
1515 GOSUB 5000
1520 REM SAVE DATA RECORD SIGNAL IDENTIFIER AS GROUP ID
1525 E5=0
1530 U$=SUBSTR(T$(1),26,6)
1540 REM SET SIGNAL GTOUP LENGTH TO ZERO
1550 N2=0
1560 REM REPEAT
1570 REM        INCREMENT SIGNAL GROUP LENGTH
1580 N2=N2+1
1585 NODATA #1,1690
1590 REM        INPUT NEXT DATA RECORD
1600 INPUT #1 ,T$(1),T$(2)
1610 REM         CHECK FOR END OF FILE
1630 REM         IF RECORD ID NOT EQUAL GROUP ID THEN
1640 IF SUBSTR(T$(1),26,6) <> U$ THEN 3010
1650 REM MOVE RECORD TO INPUT AREA
1660 R$(1,N2+1) = T$(1)
1670 R$(2,N2+1) = T$(2)
1680 GOTO 1580
1690 X1=1
3000 REM ORGANIZE PATH PATTERNS INTO PAGE FORMAT
3010  REM CLEAR PAGE ARRAY TO BLANKS
3020  FOR N5 = 1 TO R6
3030 P$(N5)="    "
3035 SUBSTR(P$(N5),1,1)="4"
3040  NEXT N5
3045  REM CLEAR FATAL ERROR FLAG
3046  K5=0
3050  REM MOVE TITLE LINE TO PAGE ARRAY
3060  SUBSTR(P$(R7),R1 ) = V$
3064 C5=59
3065 I$="4"
3070  REM MOVE SIGNAL NAME FROM FIRST RECORD INDICATED
3071  REM IN REORDERED PATH LIST TO PAGE ARRAY. INSERT BLANK BETWEEN COL 19
3075 Z$=SUBSTR(R$(1,1),10,18)
3080  SUBSTR (P$(R8),R2,16) = SUBSTR(R$(1,1),10,16)
```

REPORT Program (Cont'd)

```
3090  SUBSTR(P$(R8),R2+17,1) = " "
3100  SUBSTR(P$(R8),R2+18,2) = SUBSTR(R$(1,1),26,2)
3110  REM DECODE SIGNAL TYPE FROM SAME RECORD
3120  S$ = SUBSTR(R$(2,1),1,4)
3130  T1=6
3140  GOSUB 7010
3150  REM IF SIGNAL TYPE VALID THEN
3160  IF V1<>0 THEN 4535
3170  REM MOVE DECODED SIGNAL TYPE TO PAGE ARRAY
3180  SUBSTR(P$(R8),R3,20) = U$
3190  REM DECODE COL 24-25 OF CATEGORY
3200  S$ = SUBSTR(R$(1,1),30,2)
3210  T1=5
3220  GOSUB 7010
3230  REM CHECK IF VALID
3240  IF V1<>0 THEN 4510
3250 N$(3)=U$
3260  REM DECODE COL 22 OF CATEGORY
3270  S$=SUBSTR(R$(1,1),28,1)
3280  T1=3
3290  GOSUB 7010
3300  REM CHECK IF VALID
3310  IF V1<>0 THEN 4510
3320 N$(1)=U$
3330  REM DECODE COL 23 OF CATEGORY
3340  S$=SUBSTR(R$(1,1),29,1)
3350  T1=4
3360  GOSUB 7010
3370  REM CHECK IF VALID
3380  IF V1<>0 THEN 4510
3390 N$(2)=U$
3400  REM DECODE COL 20-21 OF SIGNAL NAME
3410  S$=SUBSTR(R$(1,1),26,2)
3420  T1=2
3430  GOSUB 7010
3440  REM CHECK IF VALID
3450  IF V1<>0 THEN 4510
3460  N$(4)=U$
3470  REM APPEND ALL STRINGS FOR SIGNAL DESCRIPTION
3480  REM MOVE SIGNAL DESCRIPTION TO PAGE ARRAY
3490  REM SET INITIAL LINE AND POSITION NUMBERS AND INITIAL LAST BLANK POSI
3500  P5=R5
3510  P6=R4
3515  P7=R4
3520  REM FOR EACH STRING
3525  FOR P8=1 TO 4
3530  REM FOR EACH CHARACTER OF THE STRING
3535  FOR P9=1 TO LEN(N$(P8))
3540  REM GET NEXT CHARACTER
3545  X$=SUBSTR(N$(P8),P9,1)
```

REPORT Program (Cont'd)

```
3550  REM CHECK IF CHARACTER IS A BLANK
3555  IF X$<>" " THEN 3575
3560  REM IF YES THEN SET LAST BLANK POSITION TO CURRENT POSITION
3565  P7=P6
3570  REM INSERT CHARACTER INTO LINE ON PAGE
3575  SUBSTR(P$(P5),P6,1)=X$
3580  REM INCREMENT POSITION INDEX
3585  P6=P6+1
3590  REM CHECK IF LINE FULL
3595  IF P6<>R9 THEN 3655
3600  REM CHECK IF CHAR IS NOT A BLANK
3605  REM SET POSITION INDEX BACK TO BEGINING AND INCREMENT LINE NUMBER
3610  P5=P5+1
3615  P6=R4
3620  IF X$=" " THEN 3655
3625  REM MOVE ALL CHARACTERS BACK TO THE LAST BLANK TO THE NEXT LINE
3630  SUBSTR(P$(P5),P6,R9-P7-1)=SUBSTR(P$(P5-1),P7+1,R9-P7-1)
3635  REM BLANK OUT END OF LINE
3640  SUBSTR(P$(P5-1),P7+1,R9-P7+1)=" "
3645  REM UPDATE POSITION POINTER
3650  P6=P6+R9-P7-1
3655  NEXT P9
3660  REM CHECK IF WORKING ON THIRD WORD
3665  IF P8<>3 THEN 3690
3670  REM IF YES INSERT COMMA
3675  SUBSTR(P$(P5),P6,1)=","
3680  REM INCREMENT POSITION
3685  P6=P6+1
3690  REM INSERT BLANK
3695  SUBSTR(P$(P5),P6,1)=" "
3700  REM INCREMENT POSITION
3705  P6=P6+1
3710  REM CHECK IF AT END OF LINE
3715  IF P6<>R9 THEN 3740
3720  REM IF YES SET POSITION TO FIRST POSITION OF LINE AND INCREMENT LINE
3725  P6=R4
3730  P5=P5+1
3735  REM SET LAST BLANK POSITION TO CURRENT POSITION-1
3740  P7=P6-1
3745  NEXT P8
3750  REM CLEAR LAST RECORD CONTAINED DESTINATION FLAG
3755  T4=0
3756 Q1=0
3760  REM SET RECORD INDEX TO FIRST RECORD
3765  T5=1
3770  REM SET LINE NUMBER TO INITIAL VALUE
3775 P5=S1
3780  REM REPEAT UNTIL CHARACTERISTIC SHEET COMPLETE
3785  REM CHECK IF CURRENT RECORD "FROM" IS AN ORIGIN
3790  REM OR IF LAST RECORD CONTAINED A DESTINATION
```

```
3795  REM CHECK LAST RECORD CONTAINED DESTINATION FLAG
3800 IF T4=1 THEN 3970
3805  REM CHECK IF "FROM" ALPHA IS ONE OR TWO CHARACTERS
3810  IF SUBSTR(R$(2,T5),7,1) = " " THEN 3840
3815  REM CHECK FOR X IN COL 80
3820  IF SUBSTR(R$(2,T5),55,1) = "X" THEN 3840
3825  REM CHECK FOR L IN COL 80
3830  IF SUBSTR(R$(2,T5),55,1)<>"L" THEN 3880
3840 REM CONTINUE
3865  REM IF YES THEN PUT X UNDER O ON CURRENT LINE
3870  SUBSTR(P$(P5),S2,1)="X"
3875 GO TO 3895
3880  REM IF NO PUT X UNDER V ON CURRENT LINE
3885SUBSTR(P$(P5),S3,1)="X"
3890  REM MOVE "FROM" ALPHA KEY TO CURRENT LINE
3895  SUBSTR(P$(P5),S4,4)=SUBSTR(R$(2,T5),5,4)
3900  REM DECODE "FROM" EQUIPMENT
3905  S$ = SUBSTR(R$(2,T5),5,4)
3910  T1=1
3915  GOSUB 7010
3920  REM CHECK IF VALID
3925  IF V1<>0 THEN 3955
3930  REM MOVE DECODED EQUIPMENT TO CURRENT AND NEXT LINE
3935  SUBSTR(P$(P5),S5,22)=SUBSTR(U$,1,22)
3940  SUBSTR(P$(P5+1),S5,22)=SUBSTR(U$,24,22)
3945  GO TO 3970
3950  REM GENERATE ERROR REPORT
3955 T7=5
3960  GOSUB 8010
3965  REM DECODE REFERENCE
3970S$ = SUBSTR(R$(2,T5),41,2)
3972 T4=0
3975  T1=7
3980  GO SUB 7010
3985  REM CHECK IF VALID
3990  IF V1<>0 THEN 4025
3995  REM IF VALID THEN MOVE REFERENCE TO CURRENT LINE
4000  SUBSTR(P$(P5),S6,21)=U$
4005  REM MOVE PAGE TO NEXT LINE
4010  SUBSTR(P$(P5+1),S6+2,2)="P "
4015  SUBSTR(P$(P5+1),S6+4,11)=SUBSTR (R$(2,T5),44,11)
4020  GO TO 4045
4025  REM IF INVALID GENERATE ERROR REPORT
4030  T7=6
4035  GOSUB 8010
4040  REM CHECK FOR E OR U IN COL 80
4045  IF SUBSTR(R$(2,T5),55,1)<>"E" THEN 4080
4050  REM IF E THEN PUT E IN REFERENCE AREA
4055  SUBSTR(P$(P5+1),S7,1)="E"
4060  REM STORE MEANING IN LEGEND
```

```
4065  SUBSTR(P$(S8),S9,22)="E = T.O. DRAWING ERROR"
4070  GO TO 4115
4075  REM IF U THEN PUT U IN REFERENCE AREA
4080IF SUBSTR(R$(2,T5),55,1)<>"U" THEN 4115
4085  SUBSTR(P$(P5+1),S7,1)="U"
4090  REM STORE MEANING IN LEGEND
4095  SUBSTR(P$(S8+1),S9,30)="U =  SIGNAL TRACING INCOMPLETE"
4110  REM MOVE FROM PLUG/PIN TO CURRENT LINE
4115  REM GET PLUG
4120  Q$=SUBSTR(R$(2,T5),9,10)
4125  REM ELIMINATE TRAILING BLANKS. T2=LENGTH ON RETURN
4128 GOSUB 9100
4130  REM MOVE TO CURRENT LINE
4135  SUBSTR(P$(P5+1),U1,T2)=SUBSTR(Q$,1,T2)
4140 REM INSERT "/"
4145  SUBSTR(P$(P5+1),U1+T2,1)="/"
4150  REM INSERT PIN
4155  SUBSTR(P$(P5+1),U1+T2+1,4)=SUBSTR(R$(2,T5),19,4)
4160  REM INCREMENT LINE NUMBER TWICE
4165 P5=P5+3
4170  REM CHECK FOR END OF PAGE
4175  GO SUB 8500
4180  REM MOVE "TO" ALPHA KEY TO CURRENT LINE
4185  SUBSTR(P$(P5),S4,4)=SUBSTR(R$(2,T5),23,4)
4190  REM DECODE "TO" EQUIPMENT
4195  S$=SUBSTR(R$(2,T5),23,4)
4200  T1=1
4205  GO SUB 7010
4210  REM CHECK IF VALID
4215  IF V1<>0 THEN 4245
4220  REM IF VALID MOVE "TO" EQUIPMENT TO CURRENT LINE
4225  SUBSTR(P$(P5),S5,22)=SUBSTR(U$,1,22)
4230  SUBSTR(P$(P5+1),S5,22)=SUBSTR(U$,24,22)
4235  GO TO 4265
4240  REM IF NOT VALID GENERATE ERROR REPORT
4245T7=5
4250  GOSUB 8010
4255  REM MOVE "TO" PLUG/PIN TO CURRENT LINE
4260  REM GET PLUG
4265Q$=SUBSTR(R$(2,T5),27,10)
4270  REM ELIMINATE TRAILING BLANKS. T2=LENGTH ON RETURN
4275  GOSUB 9100
4280  REM MOVE TO CURRENT LINE
4285  SUBSTR(P$(P5),U1,T2)=SUBSTR(Q$,1,T2)
4290  REM INSERT "/"
4295  SUBSTR(P$(P5),U1+T2,1)="/"
4300  REM INSERT PIN
4305  SUBSTR(P$(P5),U1+T2+1,4)=SUBSTR(R$(2,T5),37,4)
4310  REM CHECK IF "TO" EQUIPMENT IS A DESTINATION
4315  REM SET YES FLAG FALSE
```

```
4325  REM CHECK IF COL 50 IS BLANK
4330  IF SUBSTR(R$(2,T5),25,1)=" " THEN 4375
4335  REM CHECK IF COL 51 IS NOT BLANK
4340  IF SUBSTR(R$(2,T5),26,1)<>" " THEN 4375
4345  REM CHECK IF COL 80 IS T
4350  IF SUBSTR(R$(2,T5),55,1)="T" THEN 4375
4355  REM CHECK IF COL 80 IS L
4360  IF SUBSTR(R$(2,T5),55,1)="L" THEN 4375
4365 GOTO 4395
4370  REM SET YES DESTINATION FLAG TRUE
4375T8=1
4380  REM PUT X UNDER D ON CURRENT LINE
4385  SUBSTR(P$(P5),U2,1)="X"
4390 P5=P5+3
4392 GOTO 4450
4395  REM PUT X UNDER V ON CURRENT LINE
4400 SUBSTR(P$(P5),S3,1)="X"
4445 T4=1
4450 GOSUB 8500
4455 T5=T5+1
4460  REM CHECK IF END OF SIGNAL GROUP
4465 IF E5=2 THEN 4600
4470  REM GO PROCESS NEXT RECORD
4475  GO TO 3800
4505  REM GENERATE ERROR REPORT (INVALID SIGNAL DESCRIPTION)
4510  T7=7
4512  GOSUB 8010
4515  REM SET FATAL ERROR FLAG
4520  K5=1
4525  REM GO ON TO NEXT SIGNAL GROUP
4530  GO TO 4600
4535 REM GENERATE ERROR REPORT (INVALID SIGNAL TYPE)
4540  T7=V1
4543  GOSUB 8010
4545  REM SET FATAL ERROR FLAG
4550  K5=1
4555  REM GO ON TO NEXT SIGNAL GROUP
4560  GO TO 4600
4599 REM IF NO FATAL ERRORS THEN CONTINUE
4600 IF K5=1 THEN 6999
4910 REM IF NOT IND OF INPUT FILE THEN GO ON TO NEXT GROUP
4920 IF X1=0 THEN 1500
4940 PRINT
4950 PRINT "CHARACTERISTIC SHEETS COMPLETE"
4960 PRINT P1-1;" SHEETS WRITTEN"
4999 GOTO 5100
5000 REM CROSS INDEX ENTRY
5010 K$=STR(-P1)
5020 H$=SUBSTR(R$(1,1),10,22)
5030 S$=SUBSTR(H$,21,1)
5040 T1=9
```

REPORT Program (Cont'd)

```
5050 GOSUB 7010
5060 C(1,C1)=A1   //C(2,C1)=LOC(4)
5070 WRITE #4, H$+K$
5080 C1=C1+1
5090 RETURN
5100 RESTORE #4
5105 FOR N5=1 TO R6
5108 P$(N5)="    "
5110 SUBSTR (P$(N5),1,1)=""
5120 NEXT N5
5121 S$=Y$
5122 T1=8
5123 GOSUB 7010
5125 V$=U$+"  PNWD SIGNAL CATEGORY INDEX"
5130 SUBSTR(P$(R7),R1)=V$
5140 P1=1
5150 P5=U3
5155 C2=0
5157 C1=C1-1
5160 FOR K=1 TO C1
5180 C3=1E4
5190 FOR I=1 TO C1
5200 IF C(1,I) < C2 THEN 5250
5210 IF C(1,I) >= C3 THEN 5250
5220 C3=C(1,I)
5230 C4=C(2,I)
5240 J=I
5250 NEXT I
5260 C2=C3
5270 D(1,K)=C3
5280 D(2,K) = C4
5290 C(1,J) = 1E4
5310 NEXT K
5315 N2=C1
5320 FOR T5= 1 TO N2
5330 SET #4,D(2,T5)
5340 READ #4,H$
5341 S$=SUBSTR(H$,21,1)
5342 T1=9
5343 GOSUB 7010
5344 IF U$=V$ THEN 7052
5345 SUBSTR(P$(P5),U4,18)=U$
5350 V$=U$
5360 SUBSTR(P$(P5),U5,18)=SUBSTR(H$,1,18)
5370 SUBSTR(P$(P5),U6)="4"+SUBSTR(H$,23)
5380 P5=P5+2
5390 I$="5"
5395 C5=55
5400 GOSUB 8500
5410 NEXT T5
```

REPORT Program (Cont'd)

```
5500 PRINT "CROSS INDEX COMPLETE"
5600 PRINT P1-1;" SHEETS WRITTEN"
6900 PRINT "PROCESSING COMPLETE"
6905K$="REP,"+E$
6910 CLOSE#3;K$
6912 K$="REP,CROSIND"
6914 CLOSE #4;K$
6915 ON ERROR THEN 9400
6920 PRINT "REPORT PAGES IN FILE ";E$
6999 STOP
7000  REM DECODE SUBROUTINE
7005  REM DECODE TABLES IN A$(I,J) WITH TABLE ID IN I, TABLE ENTRY IN J
7006  REM ENTRY ITEMS 1-4=TABLE, 5-10= A/C, 11-20=CODE, 21-80=DECODE
7010 V1=0.
7012 Q$=S$
7014 GOSUB 9100
7016 S$=Q$
7020 ON T1 GOTO 7070,7220,7220,7220,7220,7220,7070,7220,7220
7050  GOTO 7400
7051 REM ADD CATEGORY TO FIRST ENTRY OF INDEX PAGES
7052 IF P5<>7 THEN 5360
7054 SUBSTR(P$(P5),U4,18)=U$
7056 GOTO 5360
7060  REM ***TABLES ONE AND SEVEN***
7070  A1=0
7080  A1=A1+1
7090  IF SUBSTR(A$(T1,A1),5,3)=Y$ THEN 7130
7100  IF A1=51 THEN 7080
7110  V1=T1
7120  GOTO 7400
7130 Q$=SUBSTR(A$(T1,A1),11,10)
7132 GOSUB 9100
7134 IF Q$=S$ THEN 7280
7135 C$=SUBSTR(A$(T1,A1),1,4)
7140 F5=VAL(C$)
7145 IF F5=T1 THEN 7080
7150  V1=T1
7160  GOTO 7400
7170  Q$ = SUBSTR(A$(T1,A1),21,60)
7180  GOSUB 9100
7190  U$=Q$
7200  GOTO 7500
7210  REM ***TABLES TWO THROUGH SIX, EIGHT AND NINE-T1=TABLE NO.***
7220  A1=0
7230  A1=A1+1
7235 Q$=SUBSTR(A$(T1,A1),11,10)
7240 GOSUB 9100
7243 IF Q$=S$ THEN 7280
7245 C$=SUBSTR(A$(T1,A1),1,4)
7250 F5=VAL(C$)
```

REPORT Program (Cont'd)

```
7255 IF F5=T1 THEN 7230
7256 IF T1=2 THEN 7258
7257 IF T1<>4 THEN 7260
7258 U$=" "
7259 GOTO 7500
7260  V1=T1
7270  GOTO 7400
7280  Q$ = SUBSTR (A$(T1,A1),21,60)
7290  GOSUB 9100
7300  U$=Q$
7310  GO TO 7500
7390  REM *** ERROR RETURN ***
7400  PRINT "DECODING ERROR IN TABLE ";T1;S$;" PROCESSING CONTINUING"
7410 PRINT "IN DATA LINE ";R$(1,1)
7420 PRINT R$(2,1)
7430 PRINT S$;" SHOULD BE ";SUBSTR(A$(T1,A1),11,10)
7490  REM *** NORMAL RETURN ***
7500  RETURN
8000  REM GENERATE ERROR REPORTS ON TERMINAL
8010  ON T7 GO TO 8050,8110,8140,8180,8210,8240,8280
8015 X$=SUBSTR(R$(1,T5),1,5)
8020  PRINT "UNDECIPHERABLE ERROR CONDITION"
8030  STOP
8040  REM AIRCRAFT CODE ERROR STOPS PROGRAM. DATA MUST BE CORRECTED
8050  PRINT "INVALID AIRCRAFT CODE"
8060 STOP
8070  REM ORIGIN ERROR STOPS SIGNAL PROCESSING. PROGRAM CONTINUES.
8080  PRINT "ORIGIN DATA NOT FOUND FOR SIGNAL ",Z$
8090  RETURN
8100  REM SIGNAL TYPE         ERROR STOPS SIGNAL PROCESSING.
8110  PRINT "INVALID SIGNAL TYPE FOR SIGNAL ";Z$;" ,DATA RECORD ";X$
8120  RETURN
8130  REM SIGNAL DESCRIPTION ERROR STOPS SIGNAL PROCESSING.
8140  PRINT "INVALID SIGNAL DESCRIPTION CODES FOR SIGNAL ";Z$
8150  PRINT "DATA RECORD "; X$
8160  RETURN
8170  REM NETWORK LOGIC ERRORS STOPS SIGNAL PROCESSING.
8180  PRINT "INCONSISTENT SIGNAL NETWORK FOR SIGNAL ";Z$
8190  RETURN
8200  REM EQUIPMENT DATA CODE ERROR LEAVES BLANK FIELD ON SHEET
8210  PRINT "INVALID ALPHA CODE FOR SIGNAL ,";Z$;" DATA RECORD ";X$
8220  RETURN
8230  REM REFERENCE CODE ERROR LEAVES BLANK FIELD ON SHEET
8240  PRINT "INVALID REFERENCE CODE FOR SIGNAL ";Z$
8250  PRINT " ,DATA RECORD "; X$
8260  RETURN
8270  REM CATEGORY ERROR STOPS SIGNAL PROCESSING.
8280  PRINT "INVALID CATEGORY FIELD FOR SIGNAL "; Z$
8290  RETURN
8500 REM CHECK FOR END OF GROUP
```

```
8505 IF T5=N2 THEN 8650
8520 IF P5<52 THEN 8700
8540 GOSUB 9000
8550  REM INSERT CONTINUED IN SIGNAL NAME AREA
8555 IF I$="5" THEN 8580
8560  SUBSTR(P$(R8),R2+20,12) =" (CONTINUED)"
8570  REM SET LINE NUMBER TO 15
8580 IF I$="4" THEN 8584
8582 P5=U3  //GO TO 8590
8584 P5=S1
8590  REM CLEAR SIGNAL ROUTING, LEGEND, AND PAGE NUMBER
8591 FOR I=P5 TO R6
8592 P$(I)="     "
8593 SUBSTR (P$(I),1,1)=""
8594 NEXT I
8600 GOTO 8700
8650 E5=E5+1
8660 IF E5=1 THEN 8520
8670 GOSUB 9000
8700 RETURN
9000  REM INSERT PAGE NUMBER AND EJECT
9005 P2=-P1
9010 K$=STR$(P2)
9015 PRINT P1;
9017 F4=LEN(K$)+2
9020 SUBSTR(P$(C5),35,F4)=I$+K$
9030 P1=P1+1
9051 MARGIN #3,80
9053 FOR I=1 TO 66
9055 PRINT #3,P$(I)
9057 NEXT I
9060  RETURN
9100  REM ELIMINATE TRAILING BLANKS
9110  T2 = LEN(Q$)
9120  IF SUBSTR(Q$,T2,1) = " " THEN 9140
9130  GO TO 9180
9140  T2 = T2-1
9150  IF T2<>0 THEN 9120
9180  Q$=SUBSTR(Q$,1,T2)
9190  RETURN
9400 IF ESM(X)=182 THEN 9540
9500 PRINT "ERROR";ESM(X);" AT PROGRAM LINE ";ESL(X)
9510 PRINT "PROCEED";
9520 INPUT G$
9530 IF G$<>"YES" THEN 9998
9540 JUMP NXL(ESL(X))
9998 STOP
9999 END
```

APPENDIX D

PNWD DATA PROCESSING INSTRUCTIONS

These instructions define the procedures for 1) generating the equipment list, signal characteristic sheets, and signal category index for the Navigation Equipment Integration Handbook; and 2) operating the remote computer terminal for the KRONOS 2.1 timeshare operating system for printing the NEIH.

D.1 REFERENCES

D.1.1 Programs

The four programs for processing the PNWD data are:

a. GROUPER – Organizes aircraft data into logical groups

b. SORTER – Sorts the aircraft data into proper sequence

c. REPORT – Decodes and formats data into report pages

d. EQUIP – Lists and formats equipment key codes.

D.1.2 Files

Files associated with PNWD data processing include:

a. XXX*, etc. – Aircraft coded data; file name is aircraft code

b. DXXX, etc. – Aircraft decode tables; file name is D + aircraft code

c. GXXX, etc. – GROUPER output; file name is G + aircraft code

d. SRTXXX, etc. – SORTER output; file name is SRT + aircraft code

e. RPTXXX, etc. – REPORT output; direct access file; file name is RPT + aircraft code

f. EQLXXX, etc. – EQUIP output; file name is EQL + aircraft code.

*XXX is the alpha code for the aircraft of interest. (See Table A-1, Appendix A, for the correct code.)

D.2 PROCEDURES

Procedures for operating the remote computer terminal for the KRONOS timeshare operating system are as follows:

a. Enter aircraft PNWD data.

1) Take punchcard decks (aircraft data, and aircraft tables) to the Control Data Corporation computer center. Input the two decks, one at a time, with a "Transfer to KRONOS" lead-in job deck. Decode tables must be ordered 1-9.

2) Log in on the remote terminal.

3) Command CATLIST. Verify that the two decks are in the KRONOS file.

b. Establish output files.

1) Enter NEW, XXX.

2) Enter SAVE (to establish file).

3) Enter NEW, SRTXXX.

4) Enter SAVE (to establish file).

5) Enter NEW, EQLXXX.

6) Enter SAVE (to establish file).

7) Enter DEFINE, RPTXXX.

8) Enter RETURN, RPTXXX (to establish direct access file).

9) Enter PERMIT, RPTXXX, L5135 = W (to allow output under less expensive flat-rate job number).

c. Generate equipment list.

1) Command BASIC, OLD, EQUIP. (Note: If using flat-rate job number, L5135, command HELLO. Log in with L501193 before calling up EQUIP.)

2) Command RUN, MA = 60000.

3) Program EQUIP requires two responses from the operator. When asked for the input file, respond DXXX. When asked for the output file, respond EQLXXX.

4) When program complete, command OLD, EQLXXX.

5) Command LNH. (Note: Change to white, unlined paper if not in terminal.)

d. Generate signal characteristic sheets and signal category index.

1) Command OLD, XXX.

2) Command RESEQ.

3) Command REP.

4) Command OLD, GROUPER.

5) Command RUN, MA = 60000.

6) Program GROUPER requires two responses from the operator. When asked for the input file, respond XXX. When asked for the output file, respond GXXX.

7) Command BASIC, OLD, SORTER.

8) Command RUN.

9) Program SORTER requires two responses from the operator. When asked for the input file, respond GXXX. When asked for output file, respond SRTXXX.

10) Command OLD, REPORT.

11) Command RUN, MA = 75000.

12) Program REPORT requires three responses from the operator. When asked for the input file, respond SRTXXX. When asked for the output file, respond RPTXXX. When asked for the decode file, respond XXX. (Note: Program REPORT prints out page numbers as they are processed. For long data files, the time limit may expire. If the terminal indicates TIME LIMIT, command T, 600.)

13) Switch to flat-rate job number. Command HELLO. Log in, using L5135 job number.

14) Command ATTACH, RPTXXX/UN = L501193.

15) Enter LNH, F = RPTXXX but no carriage return.

16) Change paper to signal characteristic sheet forms, line up reference mark.

17) Command carriage return (CR).

18) When all signal characteristic sheets are printed, press INTERRUPT switch.

19) Command REWIND, RPTXXX.

20) Command -XEDIT(F=RPTXXX).

21) Command L/4-YYY/, where YYY is the last characteristic sheet page number.

22) Command N8.

23) Enter P*, but do not enter carriage return.

24) Change paper to cross-index forms, line up reference mark.

25) Command carriage return (CR).

26) Command END.

27) Command REWIND, RPTXXX.

28) Command RETURN, RPTXXX.

APPENDIX E

HANDBOOK MAINTENANCE

The utility of the Navigation Equipment Integration Handbook is directly related to the accuracy and currency of its contents. This appendix describes the types of changes that could impact on those properties, and the procedures and responsibilities for maintaining the handbook.

E.1 TYPES OF HANDBOOK CHANGES

Changes or revisions to the NEIH could be caused by any of the following:

a. Handbook documentation errors

b. Addition, deletion, or retrofit of equipment in the PNWD system

c. Other modification of the PNWD system

d. Technical Order errors.

With the exception of handbook errors, these PNWD system changes are usually initiated with the issuance of TCTOs and/or TO change pages that describe and document the PNWD system modifications being made in the aircraft maintenance TOs. These TOs were the primary source for the data contained in the NEIH, and any changes to them could have a significant impact on the contents of the handbook. It is therefore imperative that these modifications be reviewed and incorporated into the handbook if applicable. The following paragraphs describe the impact that these types of changes will have on the handbook.

E.1.1 Handbook Errors

Documentation errors found by the users of the handbook should be reported on a copy of the error reporting form included in Section 2 of the NEIH, and as reproduced in Figure E-1. These errors will be randomly located and could be of a compound nature, i.e., an error in one section of the NEIH could affect the data in another section.

E.1.2 Equipment Addition

When a system or unit is added to the aircraft configuration and affects the PNWD functions, it may be necessary to change both the manually and computer produced handbook sections. If the new equipment is part of the navigation avionics suite, descriptive information must be manually entered in the physical characteristic and bibliography sections, if applicable. Unless sufficient space is available in the handbook text because of previous equipment or documentation deletions, the new entries will be placed at the end of the section. If sufficient space is not available there, new pages will be required at the end of the section.

TO: AFLC/AQMP
Wright-Patterson AFB, Ohio 45433

Date

SUBJECT: Integration Handbook Error, Aircraft Model _____

Description of error:

Change recommendation:

Integration handbook pages affected (if applicable, duplicate affected pages, mark corrections, and append hereto)

Reference T.O. or other document that show correct information (include change date, page/ drawing numbers)

Originator (include name and phone number of cognizant individual)

Figure E-1. Error Reporting Form

The effect of an equipment addition on the PNWD block diagram section will depend upon the results from the computer-generated sections. Block diagram changes will be made after the computer-generated signal characteristic sheets are completed. The routing and possibly rerouting of signals to the new blocks will then be entered and annotated.

The addition of a new system or equipment will require augmentation of the signal routing data in the handbook. These data will have to be coded and entered into the computer program, and additions to the decode tables will be needed. The output from the computer will be new signal characteristic sheets, and additions to the PNWD equipment list and PNWD signal category index.

E.1.3 Equipment Deletion

Removal of equipment from the PNWD configuration will require the deletion of material from Sections 3 through 7 of the handbook. Handbook entries relating to the removed equipment will be deleted and blank spaces left, so as not to change the continuity of subsequent pages of the handbook.

Changes to the handbook to account for deleted equipments will be in a manner requiring a minimum amount of reprocessing by the computer.

Depending on the quantity of data affected, signal characteristic sheets will either be removed entirely or partially revised, with blanks appearing where the affected data were previously entered. The appropriate blocks on the block diagrams will be removed, as well as affected data in the equipment list and physical characteristic table.

E.1.4 Equipment Retrofit

Equipment retrofit – the removal of certain PNWD equipment to accommodate new or updated equipment – could have a significant impact on the NEIH. Changes in equipment, signal routing, and the signals themselves could necessitate extensive alteration of the handbook data. The impact could be severe enough to require a complete revision of a handbook volume.

It is also possible that the retrofit would be only a one-for-one swap, requiring no more than a change to the system nomenclature. In this case the signals, signal routing, and physical characteristics would remain the same. The equipment nomenclature would have to be changed on the equipment list, block diagrams, signal characteristic sheets, and physical characteristic tables.

E.1.5 System Modification

Modifications to the PNWD system that do not result in the addition, removal, or replacement of equipment would consist primarily of rerouting of existing system signals. In that case, signal characteristic sheets and block diagrams would be the most seriously affected sections of the handbook.

E.2 CHANGE PROCEDURES

The general procedure for handbook changes will be similar to that practiced for aircraft and avionics TOs. As a rule, handbook change-pages will be prepared when a modification to the PNWD system affects a minor amount of handbook pages, while the handbook will be completely revised and reissued when:

a. A majority of its pages are affected

b. The number of cumulative changes has made the handbook difficult to use.

E.2.1 Change Number

As a volume of the NEIH is changed or revised, a change/revision page will be inserted in the front of the volume to indicate the affected pages. Each change will be assigned an identification number and dated, and the pages changed will include that number in a readily discernible area.

E.2.2 Change Symbols

Changes to the handbook text and tables, including new material, will be annotated with a vertical line in the margin opposite the binding edge, spanning the entire area of the material affected. This line will "flag" current changes only; lines denoting previous changes will be deleted.

Changes to block diagrams will be annotated by shading or screening the area changed. Extensively changed areas may be annotated by a screen border around the area affected.

E.2.3 Page Numbering

Pages inserted in the handbook text will be assigned the preceding page number plus consecutive capital-letter suffixes. For example, three pages added between 4-40 and 4-41 would be assigned the number 4-40A, 4-40B, and 4-40C. The suffix letters I and O will be preceded by a hyphen to avoid confusion with the numbers one and zero. When a change deletes a signal characteristic sheet entirely, a blank sheet will remain in that location for future use with the same page number. The signal category index will be changed by deleting that signal and its page number from the index.

E.2.4 Revisions

Complete revisions to a handbook volume will require the approval of the procuring activity responsible for handbook maintenance. As a general rule, a revision will be required when more than 50% of the pertinent handbook data are affected by the changes and/or previous changes.

In a complete revision, all pages, diagrams, and tables will be renumbered as necessary to eliminate previously assigned suffixes and to establish the correct numbering sequence. All references to change numbers and dates, change symbols, and shading and screening will be removed from the revised edition.

E.3 MAINTENANCE RESPONSIBILITIES

Maintenance of the Navigation Equipment Integration Handbook is the responsibility of AFLC and the handbook user, as discussed in the following paragraphs.

E.3.1 AFLC Responsibilities

AFLC will determine document change requirements and will develop, publish, and distribute handbook change data in the form of replacement pages. The change data will be distributed to the handbook users on an as-required basis for incorporation into the handbook. An Index of Changes listing all changes affecting the NEIH will also be published semiannually and distributed to handbook users, for their review to determine the currency of the documents assigned to them.

E.3.2 Handbook User Responsibilities

Users of the NEIH are responsible for:

a. Incorporating all changes published and distributed by AFLC

b. Reporting all discovered errors in the handbook data by filling out the error reporting form (Figure E-1), and sending it to the responsible AFC maintenance activity

c. Reviewing the Index of Changes to ensure the currency of the documents they hold.

E.4 HANDBOOK MAINTENANCE TASK

Tasks required to maintain the accuracy and currency of the NEIH volumes consist primarily of:

a. Receiving and reviewing all pertinent TCTOs and error reporting forms for the 33 aircraft to determine the extent of handbook changes required

b. Implementing the necessary action to change the handbook data

c. Producing, publishing, and distributing the replacement pages in the change package.

Figure E-2 is a flow diagram of the maintenance task. The following paragraphs provide details of the requirements for performing this task.

E.4.1 Computer Programming Requirements

A new computer program will be required to perform NEIH maintenance on the computer-produced handbook sections. The maintenance program must be compatible with existing NEIH report generation programs, and must manipulate, edit, and format handbook change data without disrupting or destroying the previously stored data. In particular, the maintenance program should:

a. Operate successfully on the computer-produced section of the NEIH

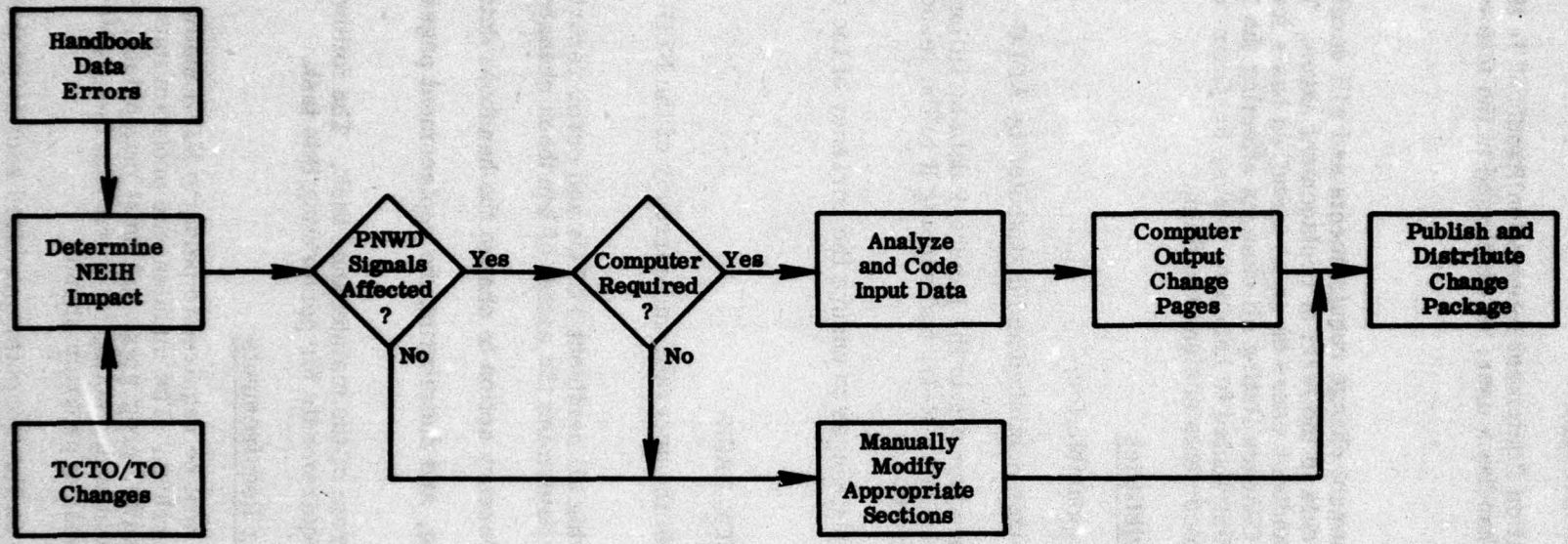

Figure E-2. Handbook Maintenance Task Flow Diagram

b. Accept change data in the input format originally developed for the NEIH

c. Allow manipulation of input data to make the necessary changes in NEIH-stored records for affected pages in the computer-produced sections

d. Output new or changed pages for those affected by the input change data.

E.4.2 Data Analysis

The initial steps in the handbook maintenance process will be review and analysis of TCTO and error report form data to determine their impact on the handbook contents. For those TCTO items that impact the PNWD system, further analysis must be performed to determine the resultant effects on the NEIH and the necessary input data required to incorporate the changes.

E.4.3 Change Incorporation

During the analysis task described in Section E.4.2, the particular handbook sections affected will have been determined. Based on this information, the method for incorporating the change can be established. Changes to the NEIH will be accomplished by automated and/or manual means as appropriate.

For those changes not requiring an extensive revision to the handbook, it might be desirable and more efficient to enter the changes manually in the computer produced sections and change the data base for that aircraft accordingly. With the approval of the procuring activity on an individual case basis, such changes will be handled by notification to handbook users to execute a "pen and ink" entry of change material. All pages containing minor changes made in this manner will be reprinted and distributed semiannually, along with a complete index to all NEIH changes made during the preceding six months.

E.4.4 Data Collection

Data collection activities will also be required during the handbook maintenance task. Particular emphasis in this area will be on:

a. Collecting and assembling TCTO and error reporting form data provided by the NEIH Central Control Activity (AFLC). This includes incorporating the TCTO data into the appropriate aircraft TOs and maintaining this data base current during the maintenance task.

b. Receiving and incorporating TO change data into existing TO data base.

c. Collecting physical characteristic data on the new pieces of PNWD equipment being incorporated by the change, as well as for existing items for which this information is missing.

d. Compiling the bibliographical material required by the change.

E.4.5 Change Production and Distribution

The production and distribution of change pages will involve steps similar to those used during the original handbook production phase. Computer output data will

be printed in the proper format on the correct handbook forms, and the manually entered data will be typed in the appropriate manual. The required quantity of change pages will then be published and assembled into change packages, with incorporation instructions, for distribution to all holders of the handbook as identified on the approved distribution list. The exact handling, transmittal, and distribution plan should be developed through a joint effort of the procuring maintenance activities.

END
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